IDAHO
DEPARTMENT OF FISH AND GAME

FEDERAL AID IN FISH RESTORATION
Job Performance Report
Program F-71-R-15

REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS

Job No. 1-a.	Region 1 Mountain Lakes Investigations
Job No. 1-b[1].	Region 1 Lowland Lakes Investigations-Largemouth Bass Evaluations
Job No. 1-b[2].	Region 1 Lowland Lakes Investigations
Job No. 1-c[1].	Region 1 Rivers and Streams Investigations-Northern Squawfish Control Effort
Job No. 1-c[2].	Region 1 Rivers and Streams Investigations-Spokane Fishery Evaluation
Job No. 1-d.	Region 1 Technical Guidance

By

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February 1997
IDFG 97-6

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JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No: F-71-R-15

Title: Region 1 Mountain Lakes Investigations

Job No.: 1-a

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

During 1990, management personnel coordinated with hatchery personnel, conservation officers, sportsmen, and the U.S. Forest Service to manage mountain lakes in Region 1. Westslope cutthroat trout Oncorhynchus clarki lewisi were stocked in 25 lakes, rainbow trout O. mykiss in 3, grayling Thymallus arcticus in 4, brown trout Salmo trutta in 3, golden trout O. aguabonita in 2, and 1 lake received brook trout Salvelinus fontinalis and splake S. fontinalis x S. namaycush. Drive-to lakes were stocked with unspecified stock of catchable rainbow trout. Mountain lake stocking is summarized for the past 11 years.

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OBJECTIVES

1. To develop improved management plans for fish populations of mountain lakes in Region 1.

2. To evaluate limnological conditions in selected mountain lakes, their fish populations, angler satisfaction and preferences. Use new and existing information on angler use, water quality, species history, spawning potential, stocking success, and lake morphology to develop the potential of these waters for providing diverse angling experiences.

METHODS

Information on mountain lakes in Region 1 was reviewed with hatchery personnel and individuals from other agencies and groups to coordinate releases of fish in 1990. The stocking program was based on previous history, reports of fishing quality, and availability of fish for release in 1990.

RESULTS

The mountain lake stocking program for 1990 was completed with minimal changes. All lakes received fish that were scheduled for stocking in 1990.

Westslope cutthroat trout *Oncorhynchus clarki lewisi* were stocked in 25 lakes. Fingerlings were substituted for fry in Roman Nose #3, and Antelope Lake received some surplus cutthroat broodstock.

Lakes intended for rainbow trout *O. mykiss* stocking all received fish in 1990, but the stock of rainbow trout varied. Domestic Kamloops, Mt. Lassen, and Blackfoot Reservoir stock of rainbow trout were used.

All lakes intended for specialty fish stocking received fish during 1990. Four lakes were stocked with grayling *Thymallus arcticus* and two with golden trout *O. aquabonita.* Three lakes were stocked with brown trout *Salmo trutta* exceeding 150 mm in an attempt to control stunted brook trout *Salvelinus fontinalis* populations. Bloom Lake was stocked with brook trout and splake *S. fontinalis* x *S. namaycush* (a brook trout/lake trout hybrid) in 1990. Stocking histories for all mountain lakes in Region 1 are summarized in Table 1 for the period 1980-1990.

Not enough creel census data was available for 1990 to evaluate program goals.

The stocking schedule for Region 1 mountain lakes attempts to balance the number of each species of fish and the number of lakes to be stocked each year (Tables 2 and 3). Deviations from the schedule have most often been caused by lack of fish, lack of proper sized fish (too large at stocking time), or conflicts with other hatchery programs. Lakes in the Little North Fork Clearwater drainage were stocked by plane from the McCall Hatchery in 1990.

Table 1. Number and species of fish (fry except where noted) stocked into mountain Lakes in Region 1 from 1980-1990

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Hidden	50	1981	15,922	318	Westslope cutthroat	
	(1-103)		1982	15,656	313	Kamloops rainbow	
			1983	12,107	242	Henrys Lake cutthroat	
			1984	12,768	255	Kamloops rainbow	
			1985	12,512	250	Westslope cutthroat	
			1986	6,000	120	Westslope cutthroat	
			1987	12,500	250	Westslope cutthroat	
			1988	12,096	242	Kamloops rainbow	
			1989	3,082	62	Kamloops rainbow	
			1989	12,495	250	Westslope cutthroat	
			1990	12,928	258	Kamloops rainbow	
	Lake Mountain	7	1983	1,723	246	Henrys Lake cutthroat	
	(Cuttoff)		1985	1,748	250	Westslope cutthroat	
	(1-109)		1987	1,750	250	Westslope cutthroat	
			1989	1,750	250	Westslope cutthroat	
	West Fork	12	1981	6,704	559	Westslope cutthroat	
	(1-109)		1982	3,648	304	Kamloops rainbow	
			1983	3,016	251	Henrys Lake cutthroat	
			1984	3,010	251	Kamloops rainbow	
			1985	2,990	250	Westslope cutthroat	
			1986	4,495	375	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1988	3,007	250	Westslope cutthroat	
			1989	3,087	257	Kamloops rainbow	
			1990	3,000	250	Westslope cutthroat	
	Long Mountain	3	1987	1,000	333	Grayling	
	(1-112)		1990	1,500	500	Grayling	
	Parker	3	1986	1,225	408	Golden trout	
	(1-113)		1988	1,002	334	Grayling	
			1990	1,410	470	Golden trout	
	Smith	6	1987	2,000	333	Grayling	
	(Long Canyon)		1988	3,000	500	Grayling	
	(1-115)		1989	3,000	500	Grayling	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Big Fisher	10	1981	3,352	335	Westslope cutthroat	
	(1-117)		1983	2,486	248	Henrys Lake cutthroat	
			1983	2,530	253	Westslope cutthroat	
			1985	2,500	250	Westslope cutthroat	
			1987	2,500	250	Westslope cutthroat	
	Myrtle	20	1983	5,189	259	Westslope cutthroat	
	(1-122)		1985	5,100	255	Westslope cutthroat	
			1987	5,000	250	Westslope cutthroat	
			1989	5,000	250	Westslope cutthroat	
	Trout	7	1981	2,514	339	Westslope cutthroat	
	(1-124)		1982	3,296	471	Kamloops rainbow	
			1983	1,720	247	Henrys Lake cutthroat	
			1984	1,733	248	Kamloops rainbow	
			1985	1,748	250	Westslope cutthroat	
			1986	1,721	246	Westslope cutthroat	
			1987	1,751	250	Westslope cutthroat	
			1988	1,743	250	Westslope cutthroat	
			1990	1,750	250	Westslope cutthroat	
	Pyramid	11	1981	4,190	381	Westslope cutthroat	
	(1-125)		1982	3,296	300	Kamloops rainbow	
			1983	2,702	246	Henrys Lake cutthroat	
			1984	2,736	249	Westslope cutthroat	
			1985	2,760	251	Westslope cutthroat	
			1986	2,741	249	Westslope cutthroat	
			1987	2,750	250	Westslope cutthroat	
			1988	2,752	250	Westslope cutthroat	
			1989	2,750	250	Kamloops rainbow	
			1990	2,765	251	Westslope cutthroat	
	Ball Creek	6	1980	2,136	356	Westslope cutthroat	
	(1-126)		1983	1,513	255	Henrys Lake cutthroat	
			1984	1,000	167	Westslope cutthroat	
			1986	1,498	250	Westslope cutthroat	
			1988	1,500	250	Westslope cutthroat	
			1990	1,500	250	Westslope cutthroat	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Little Ball Creek (1-127)	4	1980	1,424	356	Westslope cutthroat	
			1984	1,500	375	Westslope cutthroat	
			1986	956	239	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1990	1,000	250	Westslope cutthroat	
	Snow (1-134)	12	1982	3,008	301	Westslope cutthroat	
			1983	2,872	287	Henrys Lake cutthroat	
			1987	2,500	250	Westslope cutthroat	
			1989	2,400	250	Westslope cutthroat	
	Roman Nose #3 (1-137)	7	1983	2,320	193	Domestic Kamloops (size 2)	
			1985	3,00	250	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1989	3,000	250	Kamloops rainbow	
			1990	1,000	83	Westslope cutthroat (size 2)	
	Solomon (1-146)	9	1982	3,040	338	Kamloops rainbow	
			1983	2,162	240	Henrys Lake cutthroat	
			1984	2,268	252	Kamloops rainbow	
			1985	2,250	250	Westslope cutthroat	
			1986	2,500	278	Westslope cutthroat	
			1987	2,250	250	Westslope cutthroat	
			1988	2,250	250	Westslope cutthroat	
			1989	712	79	Westslope cutthroat (broodstock)	
			1990	2,250	250	Kamloops rainbow	
	Spruce (1-147)	5	1980	2,509	502	Westslope cutthroat	
			1981	2,432	486	Kamloops rainbow	
			1982	1,297	259	Henrys Lake cutthroat	
			1983	2,520	504	Kamloops rainbow	
			1984	1,250	250	Westslope cutthroat	
			1985	1,250	250	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1987	1,250	250	Westslope cutthroat	
			1988	1,250	250	Westslope cutthroat	
			1989	1,265	253	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
<u>Kootenai</u>	Queen (1-148)	5	1980	1,770	356	Westslope cutthroat	
			1983	1,296	375	Westslope cutthroat	
			1986	1,250	239	Westslope cutthroat	
			1988	1,250	250	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
	Debt (1-150)	5	1985	1,250	250	Westslope cutthroat	
			1989	1,250	250	Henrys Lake cutthroat	
	Copper (1-154)	5	1980	2,091	418	Westslope cutthroat	
			1983	1,297	259	Henrys Lake cutthroat	
			1984	1,390	278	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1988	1,247	250	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
	Callahan (Smith) (1-166)	10	1984	2,500	250	Westslope cutthroat	
			1987	2,522	252	Westslope cutthroat	
			1988	2,500	250	Westslope cutthroat	
	Estelle (1-167)	5	1988	1,075	215	Brown trout	Test control of stunted brook trout
			1990	500	100	Brown trout (size 3)	
<u>Pend Oreille</u>	Hunt (2-101)	12	1982	3,648	304	Kamloops rainbow	
			1985	3,000	250	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1987	3,033	253	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1899	5,000	417	Westslope cutthroat	
			1990	3,000	250	Westslope cutthroat	
	Standard (2-103)	16	1980	5,472	342	Westslope cutthroat	
			1983	4,021	251	Henrys Lake cutthroat	
			1985	4,000	250	Westslope cutthroat	
			1987	3,962	248	Westslope cutthroat	
			1989	4,000	250	Westslope cutthroat	
	Two Mouth #1 (2-106)	?	1981	2,258	--	Westslope cutthroat	Discontinue stocking due to winter kill.

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Two Mouth #2	5	1981	2,258	452	Westslope cutthroat	
	(2-107)		1983	2,054	411	Henrys Lake cutthroat	
			1985	1,265	253	Westslope cutthroat	
			1987	1,269	254	Westslope cutthroat	
			1989	1,265	253	Westslope cutthroat	
	Two Mouth #3	20	1981	6,774	339	Westslope cutthroat	
	(2-108)		1983	4,973	249	Henrys Lake cutthroat	
			1984	5,280	264	Westslope cutthroat	
			1986	5,000	250	Westslope cutthroat	
			1988	5,000	250	Westslope cutthroat	
			1990	5,000	250	Westslope cutthroat	
	Mollies	2	1981	3,352	1,672	Westslope cutthroat	
	(2-114)		1983	648	324	Henrys Lake cutthroat	
			1985	506	253	Westslope cutthroat	
			1987	508	254	Westslope cutthroat	
			1989	500	250	Westslope cutthroat	
	Caribou	6.8	1980	2,052	302	Westslope cutthroat	
	(near West Fk Mtn)		1984	1,752	258	Henrys Lake cutthroat	
	(2-116)		1986	1,750	257	Westslope cutthroat	
			1987	1,750	257	Westslope cutthroat	
			1988	1,750	257	Westslope cutthroat	
			1990	1,750	257	Westslope cutthroat	
	Fault	6	1981	2,258	376	Westslope cutthroat	
	(Hunt Peak #1)		1983	2,872	478	Henrys Lake cutthroat	
	(2-121)		1985	1,500	250	Westslope cutthroat	
			1987	1,500	250	Westslope cutthroat	
			1989	1,553	259	Westslope cutthroat	
	McCormick	3.1	1981	2,258	304	Kamloops rainbow	
	(Hunt Peak #2)		1985	780	250	Westslope cutthroat	
	(2-122)		1987	775	250	Westslope cutthroat	
			1989	805	253	Westslope cutthroat	

able 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Little Harrison	6.5	1981	2,258	347	Westslope cutthroat	
	(2-126)		1983	1,651	254	Henrys Lake cutthroat	
			1987	1,625	250	Westslope cutthroat	
			1988	1,625	250	Westslope cutthroat	
			1990	1,625	250	Westslope cutthroat	
	Beehive	7	1981	2,258	323	Westslope cutthroat	
	(2-128)		1983	1,723	246	Henrys Lake cutthroat	
			1985	1,740	248	Westslope cutthroat	
			1986	1,803	258	Westslope cutthroat	
			1987	1,750	250	Westslope cutthroat	
			1989	2,164	309	Westslope cutthroat	
	Harrison	29	1981	9,218	318	Westslope cutthroat	
	(2-129)		1982	6,972	240	Kamloops rainbow	
			1983	7,243	250	Henrys Lake cutthroat	
			1984	7,296	250	Westslope cutthroat	
			1985	7,200	248	Westslope cutthroat	
			1996	6,870	237	Westslope cutthroat	
			1987	7,264	250	Westslope cutthroat	
			1988	7,250	250	Westslope cutthroat	
			1989	7,479	258	Westslope cutthroat	
			1990	7,250	250	Westslope cutthroat	
	Beaver	5	1980	1,936	387	Brook trout	Test control of stunted
	(2-130)		1990	500	100	Brook trout (size 3)	brook trout
	Dennick	8	1980	2,509	314	Westslope cutthroat	
	(2-101)		1981	5,800	725	Westslope cutthroat	
			1983	1,939	242	Henrys Lake cutthroat	
			1984	2,060	258	Westslope cutthroat	
			1985	2,010	251	Westslope cutthroat	
			1886	2,500	312	Westslope cutthroat	
			1987	2,000	250	Westslope cutthroat	
			1988	2,000	250	Westslope cutthroat	
			1989	2,064	258	Westslope cutthroat	
			1990	2,000	250	Westslope cutthroat	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Sand (2-172)	5	1980	2,509	502	Westslope cutthroat	
			1981	3,480	696	Westslope cutthroat	
			1982	8,360	1,672	Kokanee	
			1983	1,221	244	Henrys Lake cutthroat	
			1984	1,254	251	Westslope cutthroat	
			1985	1,260	252	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1987	1,250	250	Westslope cutthroat	
			1988	1,247	250	Westslope cutthroat	
			1989	1,250	250	Westslope cutthroat	
			1990	1,260	250	Westslope cutthroat	
	Bloom (2-128)	20	1981	23,402	1,220	Brook trout	
			1982	10,620	531	Brook trout	
			1984	5,041	252	Brook trout	
			1985	4,599	230	Brook trout	
			1986	5,360	268	Brook trout	
			1987	5,000	250	Brook trout	
			1988	5,000	250	Brook trout	
			1989	10,013	250	Brook trout	
			1990	500	500	Brook troutg	
			1990		25	Splake (size 2)	
	Porcupine (2-182)	13	1980	4,440	342	Catchable rainbow	
			1982	1,296	100	Kamloops rainbow	
			1983	2,872	220	Domestic Kamloops (size 2)	
			1984	1,016	78	Catchable rainbow	
			1985	1,000	77	Catchable rainbow	
			1996	1,075	83	Mt. Lassen rainbow (size 3)	
			1987	--	--	--	Road washed out.
			1988	600	46	Mt. Lassen rainbow (size 3)	
			1989	690	53	Mt. Lassen rainbow (size 3)	
			1990	750	58	Catchable rainbow	
	Moose (2-185)	16.5	1987	1,000	61	Brown trout	Test control of stunted brook trout
			1988	4,515	274	Brown trout	
			1990	500	30	Brown trout (size 3)	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Antelope	16	1980	4,970	311	Catchable rainbow	
	(2-190)		1981	5,000	312	Westslope cutthroat	
			1982	5,032	314	Westslope cutthroat	
			1989	200	12	Shepard of the Hills rainbow (size 3)	
			1989	1,155	72	Mt. Lassen rainbow (size 3)	
			1990	1,000	63	Catchable rainbow	
			1990	200	12	Westslope cutthroat broodstock	
	Caribou	6.8	1983	2,872	422	Henrys Lake cutthroat	
	(near Keokee		1984	1,750	257	Westslope cutthroat	
	Mtn)		1985	1,700	250	Westslope cutthroat	
	(2-196)		1986	1,500	220	Westslope cutthroat	
			1987	1,704	250	Westslope cutthroat	
			1988	1,722	253	Westslope cutthroat	
			1989	1,700	250	Westslope cutthroat	
			1990	1,700	250	Westslope cutthroat	
Spokane	Mirror	5	1981	5,000	1,000	Westslope cutthroat	Winter kill Lake, evaluate
	(3-117)						Before further stocking.
	Elsie	10	1980	3,190	319	Catchable rainbow	Stock catchable rainbow
	(3-119)		1981	3,875	388	Catchable rainbow	annually, other fish were
			1981	49	--	Rainbow (SP)	show pond (SP) fish from
			1981	48	--	Cutthroat (SP)	Mullan Hatchery.
			1981	53	--	Brook trout (SP)	
			1981	14	--	Kokanee (SP)	
			1981	1	--	Dolly Varden (SP)	
			1982	1,440	144	Catchable rainbow	
			1983	1,500	150	Catchable rainbow	
			1984	2,865	286	Catchable rainbow	
			1985	3,005	300	Catchable rainbow	
			1886	3,024	302	Catchable rainbow	
			1987	2,000	200	Hayspur rainbow (size 3)	
			1988	4,050	405	Hayspur rainbow (size 3)	
			1989	2,856	284	Mt. Lassen rainbow (size 3)	
			1990	3,000	300	Catchable rainbow	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Spokane	Lower Glidden (3-123)	12	1980	2,030	169	Catchable rainbow	
			1981	1,950	162	Catchable rainbow	
			1982	1,880	157	Catchable rainbow	
			1983	1,000	83	Catchable rainbow	
						Catchable rainbow	
			1984	4.945	412	Catchable rainbow	
			1985	3,018	251	Catchable rainbow	
			1986	3,011	251	Catchable rainbow	
			1987	3,277	273	Hayspur rainbow (size 3)	
			1988	3,001	250	Hayspur rainbow (size 3)	
			1989	2,836	236	Mt. Lassen rainbow (size 3)	
			1990	1,775	148	Catchable rainbow	
	Upper Glidden (3-124)	10	1980	992	99	Kamloops rainbow	Evaluate Kamloops control of stunted brook trout.
	Gold (3-125)	3	1981	1,000	333	Westslope cutthroat	
			1983	1,005	335	Henrys Lake cutthroat	
			1987	750	250	Westslope cutthroat	
			1989	750	250	Westslope cutthroat	
	Revett	12	1980	992	83	Kamloops rainbow	Evaluate Kamloops control of stunted brook trout.
	Crater (3-133)	5	1983	5,000	1,000	Grayling	Reserve for grayling.
			1987	2,100	420	Grayling	
			1990	2,500	500	Grayling	
				2,500	500	Grayling	
	Dismal (3-138)	?	1980	870	--	Catchable rainbow	Reduce stocking to 250 fish and evaluate.
			1983	1,500	--	Catchable rainbow	
			1984	537	--	Catchable rainbow	
			1985	490	--	Catchable rainbow	
			1986	253	--	Catchable rainbow	
			1987	249	--	Hayspur rainbow (size 3)	
			1988	260	--	Mt. Lassen rainbow (size 3)	
			1988	260	--	Hayspur rainbow (size 3)	
			1989	225	--	Mt. Lassen rainbow (size 3)	
			1990	250	--	Catchable rainbow	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Spokane	Bacon (3-144)	9	1981	4,000	444	Westslope cutthroat	
			1985	2,255	250	Westslope cutthroat	
			1987	2,250	250	Westslope cutthroat	
			1989	2,250	250	Westslope cutthroat	
	Forage (3-146)	13	1987	3,150	242	Golden trout	Reserve for goldens or Grayling.
			1988	3,250	250	Grayling	
			1989	2,000	154	Grayling	
			1990	3,250	250	Golden trout	
	Halo (3-147)	12	1981	5,000	417	Westslope cutthroat	
			1985	3,010	251	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1989	3,000	250	Westslope cutthroat	
	Crystal (3-160)	10	1981	9,998	999	Westslope cutthroat	
			1983	4,380	438	Henrys Lake cutthroat	
			1985	2,510	251	Westslope cutthroat	
			1987	2,510	251	Westslope cutthroat	
			1988	2,500	250	Westslope cutthroat	
			1989	2,500	250	Westslope cutthroat	
Little Nork Fork Clearwater	Devils Club (6-113)	45	1981	3,014	753	Westslope cutthroat	
			1986	1,000	250	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1990	1,093	273		
	Big Talk (6-114)	?	1986	1,500	--	Westslope cutthroat	
			1988	2,500	--	Westslope cutthroat	
			1990	2,737	--	Westslope cutthroat	
	Larkins (6-117)	12	1981	3,014	502	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1990	3,278	273	Westslope cutthroat	
	Mud (6-118)	6	1981	3,014	502	Westslope cutthroat	
			1987	1,500	250	Westslope cutthroat	
			1989	1,500	250	Westslope cutthroat	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Little Nork Fork Clearwater	Hero (6-119)	4	1981	3,014	753	Westslope cutthroat	
			1986	1,000	250	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1990	1,000	273	Westslope cutthroat	
	Heart (6-122)	40	1981	3,014	75	Westslope cutthroat	.
			1986	10,000	250	Westslope cutthroat	
			1990	10,000	250	Mt. Lassen rainbow	
	Northbound (6-123)	12	1981	3,014	251	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1990	3,278	273	Westslope cutthroat	
	Skyland (6-125)	13	1981	3,014	232	Westslope cutthroat	
			1987	3,250	250	Westslope cutthroat	
			1989	34,250	250	Westslope cutthroat	
	Fawn (6-125)	13	1981	3,014	232	Westslope cutthroat	
			1986	3,250	250	Westslope cutthroat	
			1988	3,250	250	Westslope cutthroat	
			1990	3,565	274	Westslope cutthroat	
	Noseeum (6-130)	4	1981	1,174	294	Rainbow/cutthroat hybrid	
			1985	1,008	251	Westslope cutthroat	
			1987	1,000	250	Westslope cutthroat	
			1989	1,000	250	Westslope cutthroat	
	Steamboat (6-131)	9	1981	1,174	130	Rainbow/cutthroat hybrid	Reserve for grayling.
			1986	2,000	222	Grayling	
			1988	4,500	500	Grayling	
			1989	2,000	222	Grayling	
			1990	4,500	500	Grayling	
	Copper (6-201)	3	1981	1,000	333	Westslope cutthroat	
			1981	1,000	333	Rainbow/cutthroat hybrid	
			1985	765	255	Westslope cutthroat	
			1989	700	250	Westslope cutthroat	

Table 1. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Little Nork Fork Clearwater	Gold (6-202)	8	1986	2,000	250	Westslope cutthroat	
			1988	2,000	250	Westslope cutthroat	
			1990	2,185	273	Westslope cutthroat	
	Tin (6-204)	3	1987	750	250	Westslope cutthroat	
			1988	750	250	Westslope cutthroat	
			1990	750	250	Blackfoot rainbow	
	Silver (6-205)	10	1981	200	200	Westslope cutthroat	
			1981	888	89	Rainbow	
			1985	999	100	Mt. Lassen rainbow	
			1989	2,500	250	Westslope cutthroat	

Table 2. Odd-year stocking schedule for Region 1 mountain lakes.

Lake	Code number	Surface acres	Number stocked	Species	Substitute species
Kootenai					
Hidden	01-103	50	12,500	C2	K1
Lake Mountain	01-104	7	1,750	C2	None
West Fork	01-109	12	3,000	K1	C2
Long Mountain	01-112	3	1,500	GR	None
Parker	01-113	3	1,000	GN	GR
Smith	01-115	6	3,000	GR	None
Myrtle	01-122	20	5,000	C2	None
Pyramid	01-125	11	2,750	K1	C2
Snow	01-134	10	2,500	C2	None
Roman Nose #3	01-137	12	3,000	K1	C2
Spruce	01-147	5	1,250	K1	C2
Debt	01-150	5	1,250	C2	None
Callahan	01-166	10	2,500	C2	None
Pend Oreille					
Hunt	02-101	12	3,000	C2	None
Standard	02-103	16	4,000	C2	None
Two Mouth #2	02-107	5	1,250	C2	None
Mollies	02-114	2	500	C2	None
Fault	02-121	6	1,500	C2	None
McCormick	02-122	3.1	775	C2	None
Beehive	02-128	7	1,750	C2	None
Harrison	02-129	29	7,250	C2	None
Dennick	02-171	8	2,000	C2	None
Sand	02-172	5	1,250	C2	None
Bloom	02-173	20	*5,000	BK *size 2	None
Caribou (near Keokee Mtn)	02-196	6.8	1,700	C2	None
Spokane					
Gold	03-125	3	750	K1	None
Crater	03-133	5	2,500	GR	None
Bacon	03-144	9	2,250	C2	None
Forage	03-146	13	3,250	GN	GR
Halo	03-147	12	3,000	C2	None
Crystal	03+160	10	2,500	C2	None
Little North Fork Clearwater					
Mud	06-118	6	1,500	K1	None
Skyland	06-125	13	3,250	K1	None
No Seeum	06-130	4	1,000	C2	None
Steamboat	06-131	9	4,500	GR	None
Copper	06-201	3	750	C2	None
Silver	06-205	10	2,500	K1	None

Total number of fish to be stocked:
- C2 – 59,975
- K1 – 19,750
- GR – 11,500
- GN - 4,250 (grayling can be substituted for goldens)
- BK - 5,000 size 2

Table 3. Even-year stocking schedule for Region 1 mountain lakes.

Lake	Code number	Surface acres	Number stocked	Species	Substitute species
Kootenai					
Hidden	01-103	50	12,500	K1	C2
West Fork	01-109	12	3,000	C2	K1
Long Mountain	01-112	3	1,500	GR	None
Parker	01-113	3	1,000	GN	GR
Smith	01-115	6	3,000	GR	None
Big Fisher	01-117	10	2,500	C2	None
Trout	01-124	7	1,750	C2	K1
Pyramid	01-125	11	2,750	C2	K1
Ball Creek	01-126	6	1,500	C2	None
Little **Ball** Creek	01-127	4	1,000	C2	None
Roman Nose #3	01-137	12	3,000	C2	K1
Spruce	01-147	5	1,250	C2	K1
Queen	01-148	5	1,250	C2	None
Copper	01-154	5	1,250	C2	None
Estelle	01-167	5	1,250	BN	None
Pend Oreille					
Hunt	02-101	12	3,000	C2	None
Two Mouth #3	02-108	20	5,000	C2	None
Caribou (near West Fork Mountain)	02-116	6.8	1,750	C2	None
Little Harrison	02-126	6.5	1,625	C2	None
Harrison	02-129	29	7,250	C2	None
Beaver	02-130	5	1,250	BN	None
Dennick	02-171	8	2,000	C2	None
Sand	02-172	5	1,250	C2	None
Bloom	02-173	20	*5,000	BK *size 2	None
Moose	02-185	16.5	4,200	BN	None
Caribou	02-196	6.8	1,700	C2	None
Spokane					
Crater	03-133	5	2,500	GR	None
Forage	03-146	13	3,250	GN	GR
Little Nork Fork Clearwater					
Devils Club	06-113	4	1,000	C2	None
Big Talk	06-114	?	2,500	C2	None
Larkins	06-117	12	3,000	C2	None
Hero	06-119	4	1,000	C2	None
Heart	06-122	40	10,000	K1	None
Northbound	06-123	12	3,000	C2	None
Fawn	06-126	13	3,250	C2	None
Steamboat	06-131	9	4,500	GR	None
Gold	06-202	8	2,000	C2	None
Tin	06-204	3	750	K1	None

Total number of fish to be stocked:

C2 – 58,575
K1 – 23,250
GR – 11,500
GN - 4,250 (grayling can be substituted for goldens)
BK - 5,000 size 2
BN - 6,700

Species diversity will be maintained by utilizing westslope cutthroat and domestic Kamloops rainbow for most lakes, golden and grayling (when available) for specialty lakes, and brown trout for attempted control of stunted brook trout. Bull trout S. confluentus may be used to control brook trout if hatchery surpluses are available.

The lack of suitable sized domestic Kamloops rainbow has forced us to utilize different stocks of rainbow trout in order to maintain some species diversity in mountain lakes. Rainbow trout will not be stocked in mountain lakes in the Pend Oreille drainage to avoid diluting the wild Gerrard rainbow gene pool, and we will stock only westslope cutthroat in lakes specified for cutthroat.

RECOMMENDATIONS

1. Follow recommendations in Tables 2 and 3 regarding even or odd year stocking. Stock lakes that have been missed for several years, and temporarily discontinue stocking lakes where stunted fish populations are known to exist.

2. Obtain late egg takes (spring spawning) from domestic Kamloops rainbow trout so that the proper size fry are available for mountain lake stocking. If this **is** not possible, switch rainbow stocking to a different stock of fish and evaluate their success.

3. Continue species diversity program by utilizing westslope cutthroat and Kamloops rainbow trout. Obtain grayling and golden trout so unique mountain lake fisheries can become a reality.

4. Work with the Forest Service and Boundary County backpackers to create a trail into Smith Lake to provide increased angling opportunity for grayling.

5. Consider stocking grayling or golden trout into a more accessible lake to provide increased angling opportunity for specialty stocks. Consult Department personnel and interested anglers to determine suitable waters. Survey lakes and consider a restoration project to eliminate competition from non-specialty stocks.

6. Use brown trout to control stunted brook trout populations. Evaluate bull trout and splake for the same purpose when stocks become available.

7. Utilize voluntary angler reports to assess fish populations and angler satisfaction. Develop or utilize existing angler report forms to obtain this data.

8. Develop a mountain lake management plan that addresses management objectives, standardized survey techniques, and evaluation procedures for both short- and long-term goals.

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No.: F-71-R-15

Title: Region 1 Lowland Lakes Investigations-Largemouth Bass Evaluations

Job No.: 1-b[1]

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

Four lowland lakes managed under various fishery regulations were evaluated. Anderson and Thompson lakes were managed under a 356 mm (14 inch) minimum harvest length with a July 1 opener; Blue Lake was designated catch-and-release in 1990; and Rose Lake was managed under standard regulations, i.e. 305 mm (12 inch) minimum harvest length. Proportional Stock Densities for Anderson, Blue, Thompson, and Rose lakes were 83, 61, 49, and 32, respectively. Mortality estimates were 0.34, 0.42, 0.48, and 0.46 for Anderson, Thompson, Blue, and Rose lakes, respectively. Condition factor of largemouth bass *Micropterus salmoides* greater than 300 mm has decreased significantly in Thompson Lake since 1981. A minimum length limit appears to increase abundance of quality sized bass, but with a trade-off in poorer condition. It was too soon to evaluate the response of the largemouth bass population in Blue Lake to the catch-and-release regulation.

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INTRODUCTION

Largemouth bass Micropterus salmoides populations in northern Idaho have provided a quality fishing experience for anglers for many years. In the early 1980s, fishery personnel became concerned about the status of largemouth bass populations in north Idaho lowland lakes. In 1981, a study was initiated to evaluate bass populations in several north Idaho bass lakes (Rieman 1982, 1983, 1984, and 1987). One of the recommendations from this study, minimum length limits (305 mm), was implemented in Region 1 in 1984 (5 bass, none under 12 inches, only 2 over 17 inches) and statewide in 1986. Three lakes were set aside for development of a trophy bass fishery; Anderson, Blue, and Thompson lakes. Special regulations (5 bass, none under 14 inches, and harvest was permitted July 1 to December 31) were implemented in 1984. Then in 1988, Blue, Kelso, Little Round, and Granite lakes were selected as catch-and-release lakes for bass in response to local bass anglers.

Evaluation of the bass population response to minimum length limits had not been conducted in north Idaho. So in 1990, Anderson, Blue, Thompson, and Rose lakes were selected for evaluation. The evaluation of these lakes was based on criteria established by Rieman (1983). In this study, proportional stock density and the mortality rate were the two main criteria examined.

OBJECTIVES

1. Evaluate the response of the largemouth bass population in various lowland lakes managed under different fishing regulations.

2. Compare Proportional Stock Density (PSD) and growth to previous data when possible.

STUDY AREA

Anderson, Blue, and Thompson lakes were considered part of the Coeur d'Alene River lake system known as the lateral lakes or chain lakes (Figure 1). The lateral lakes can be accessed directly from the river via a channel designed for boat traffic. Rose Lake, although close to the Coeur d'Alene River, has no direct access to the river (Figure 1). The surface area of these lakes ranged from 81 hectares to 291 hectares, and mean depths ranged from 2.7 m to 4.5 m (Table 1). Warmwater game fish species present in each lake is shown in Table 1.

METHODS

Fish were collected at night using an electrofishing boat on September 10, 11, 12, and 27, 1990. The boat made one circuit around the shoreline of the lake and fish collected were placed in a live well. Largemouth bass was the target game species. Total length (mm) of all bass collected was measured and recorded. A length frequency was generated from which PSD values were calculated.

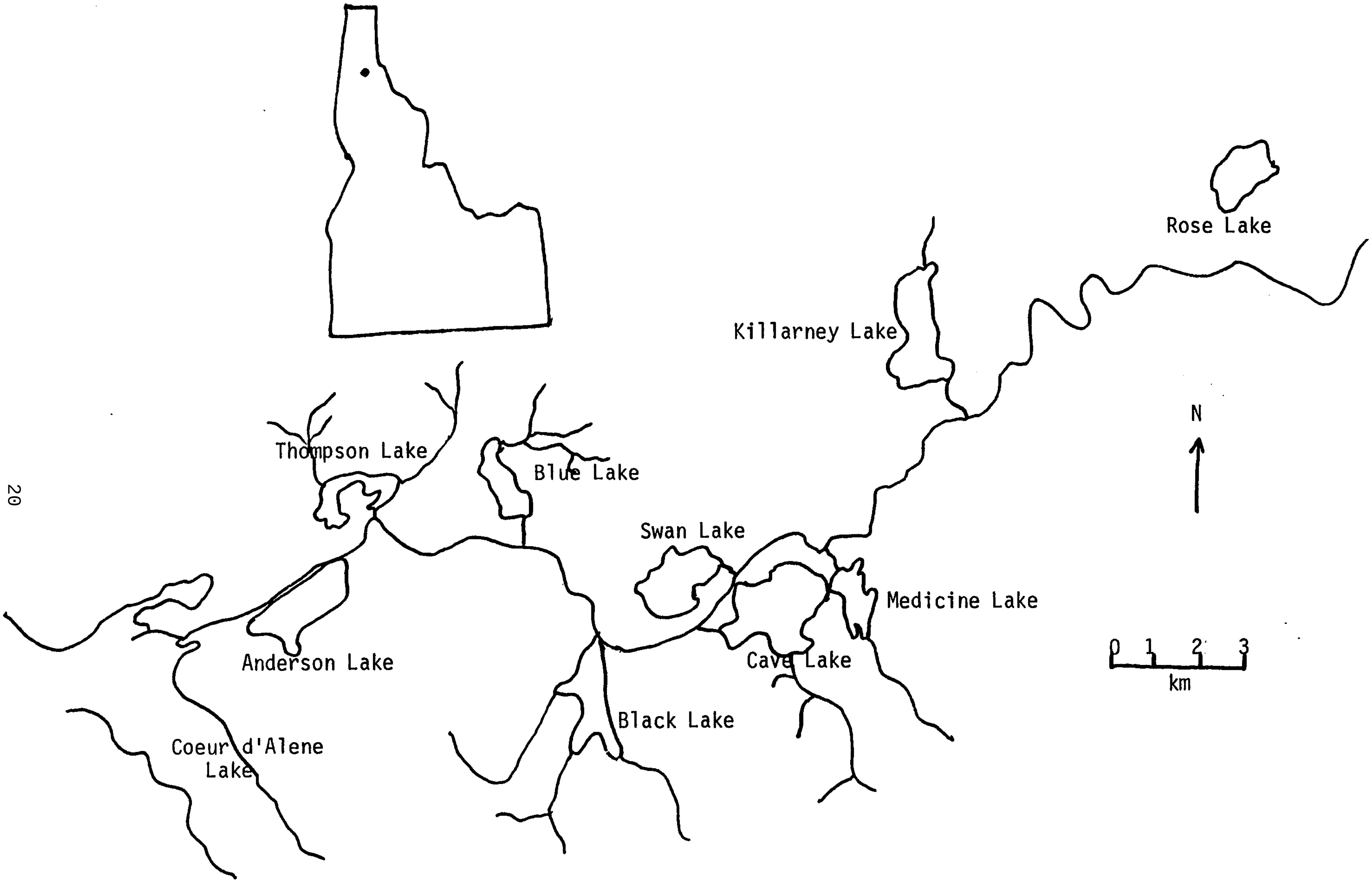

Figure 1. Location of study lakes, Anderson, Blue, Thompson, and Rose lakes, Idaho, 1990.

Table 1. Mean depth, surface area, and warmwater fish species present in Anderson, Blue, Thompson, and Rose lakes, Idaho, 1990.

Lake	Surface area (ha)	Mean depth (m)	Fish species: Largemouth bass	Black bullhead	Black crappie	Yellow Perch	Bluegill sunfish	Pumpkinseed sunfish	Northern pike
Anderson	292	3.7	X	X	X	X		X	X
Blue	81	4.5	X	X	X	X		X	X
Thompson	81	4.0	X	X	X	X		X	X
Rose	122	2.7	X	X	X	X	X	X	X

$$PSD = \frac{n \text{ fish} \geq \text{quality length (300 mm)}}{n \text{ fish} \geq \text{stock length (200 mm)}}$$

Weights (g) and scale samples were collected from a minimum of ten fish per 10 mm length group. A length/weight relationship was calculated for the bass population from each lake. Impressions of bass scales were made on acetate slides using a Carver model C laboratory press. Pressure was increased to 364 kg/cm^2 (20,000 psi) and held for 10 seconds. The number of annuli was counted using a Eberbach scale reader and recorded. An age frequency for the bass population in each lake was generated and mortality estimates were computed using the estimator developed by Chapman and Robson (1960). Catch curves were also developed and used to calculate mortality.

A computer program, Fishery Analysis Tools – Fishcalc 89 – disbcalc 89 – Scale back-calculations, was used to generate back-calculated lengths at annulus formation (program was designed by Steve Atran and available through the Florida Marine Fish Commission, Tallahassee).

Table 2. Largemouth bass proportional stock density (PSD) for various lowland lakes in north Idaho, 1990.

Lake	Number >200 mm	Number >300 mm	Number >400 mm	Number >500 mm	PSD >300 mm	PSD >400 mm	PSD >500 mm
Anderson	40	33	6	0	83	15	0
Black[a]	21	7	4	1	33	19	5
Blue	33	20	6	1	61	12	3
Rose	140	45	1	1	32	0.7	0.7
Thompson	79	39	12	1	49	15	1.3

[a]Data collected by Jeff Dillon, Research Biologist, IDFG.

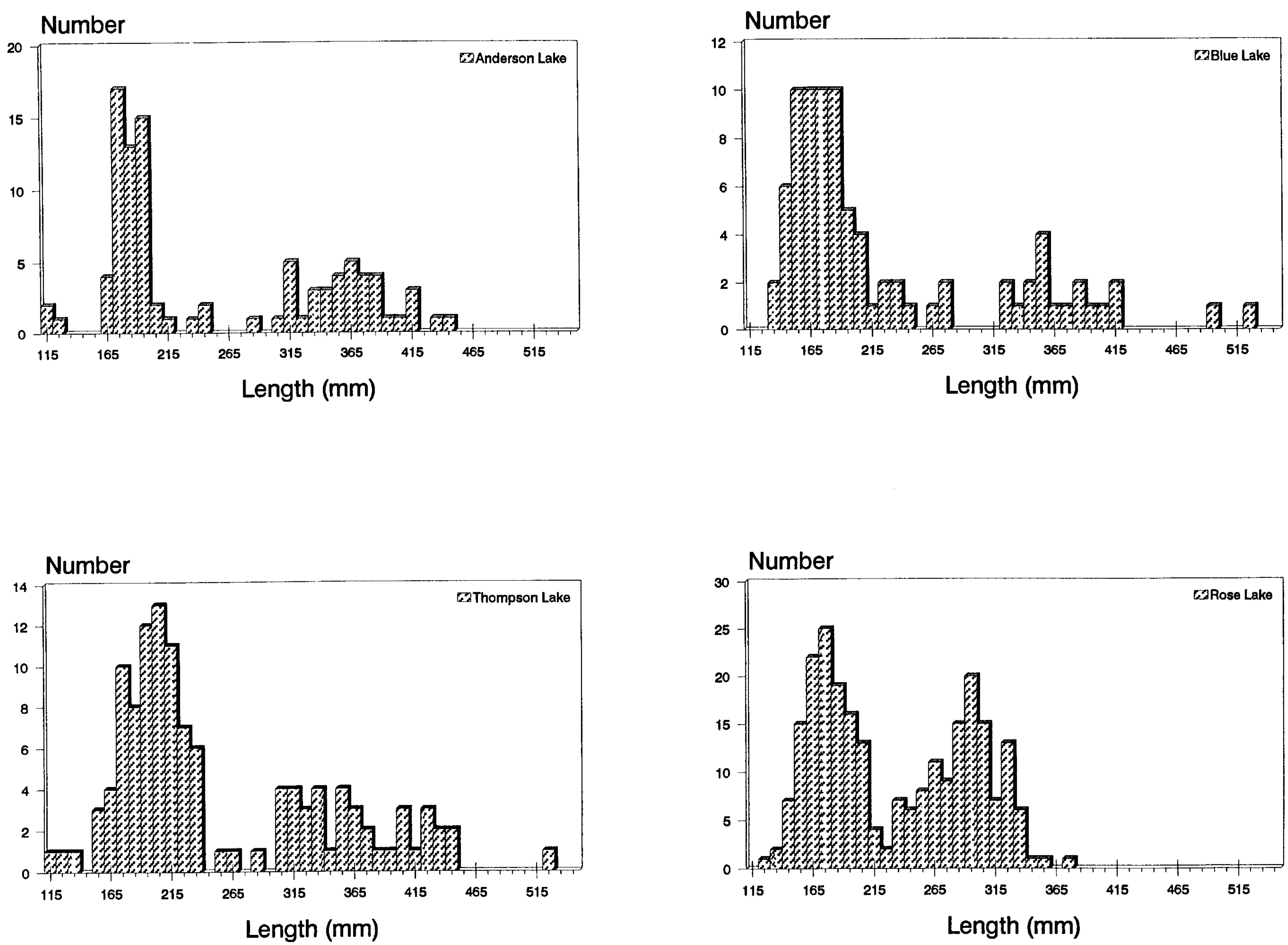

Figure 2. Length frequency of largemouth bass collected by electrofishing in Anderson, Blue, Thompson, and Rose lakes, Idaho, 1990.

Table 3. Mortality estimates of largemouth bass collected by electrofishing using Chapman-Robson estimator and catch curves for selected north Idaho lowland lakes, 1990.

Lake	Chapman-Robson			Catch curves
	Total survival (S)	Total mortality (1-S)	Instantaneous mortality (Z)	Instantaneous mortality (Z)
Anderson	0.71	0.29	0.34	0.45
Blue	0.62	0.38	0.48	0.33
Rose	0.63	0.37	0.46	0.56
Thompson	0.66	0.34	0.42	0.40

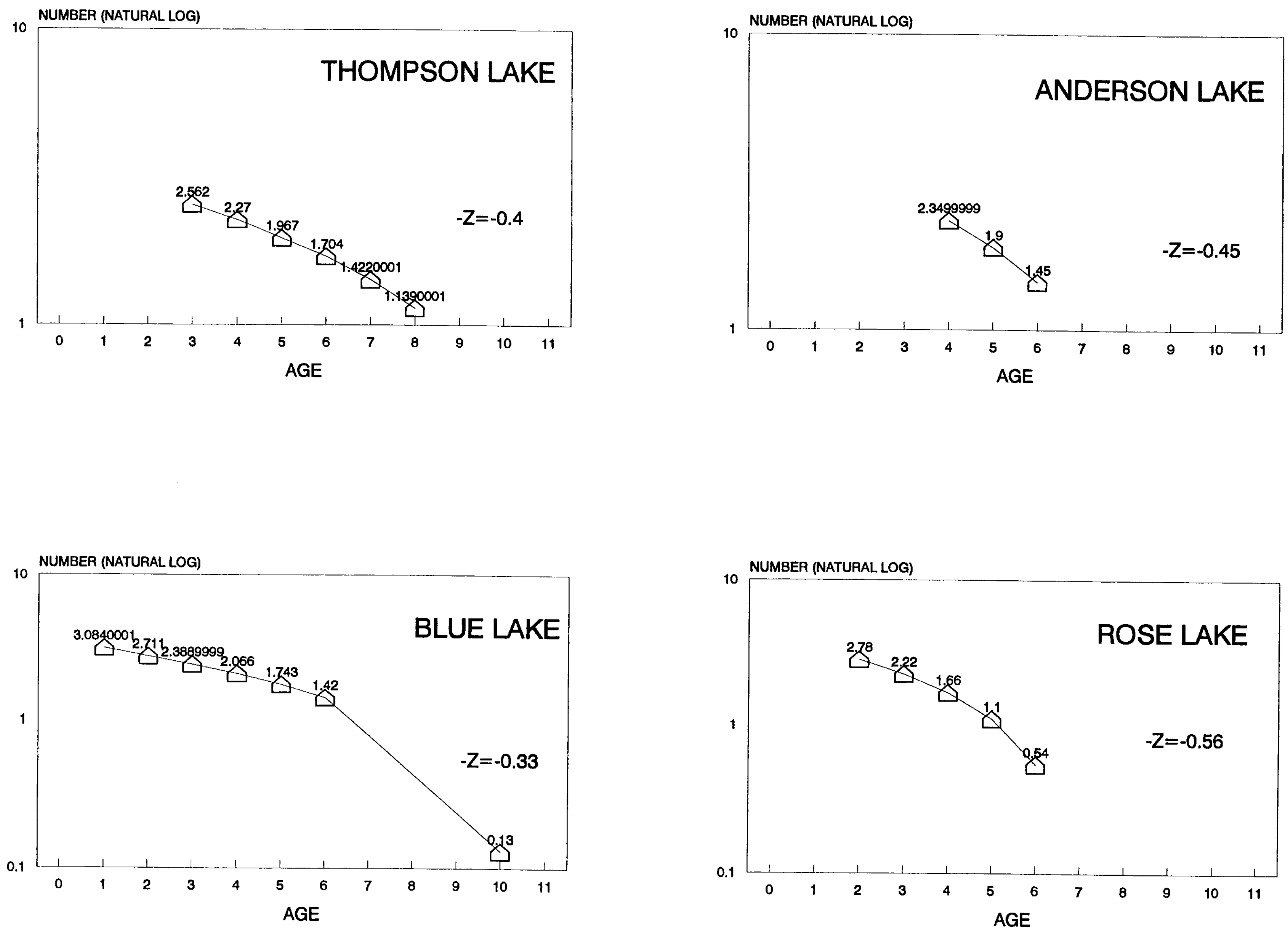

Figure 3. Mortality estimates calculated from catch curves for largemouth bass collected by electrofishing in Thompson, Anderson, Blue, and Rose lakes, Idaho, 1990.

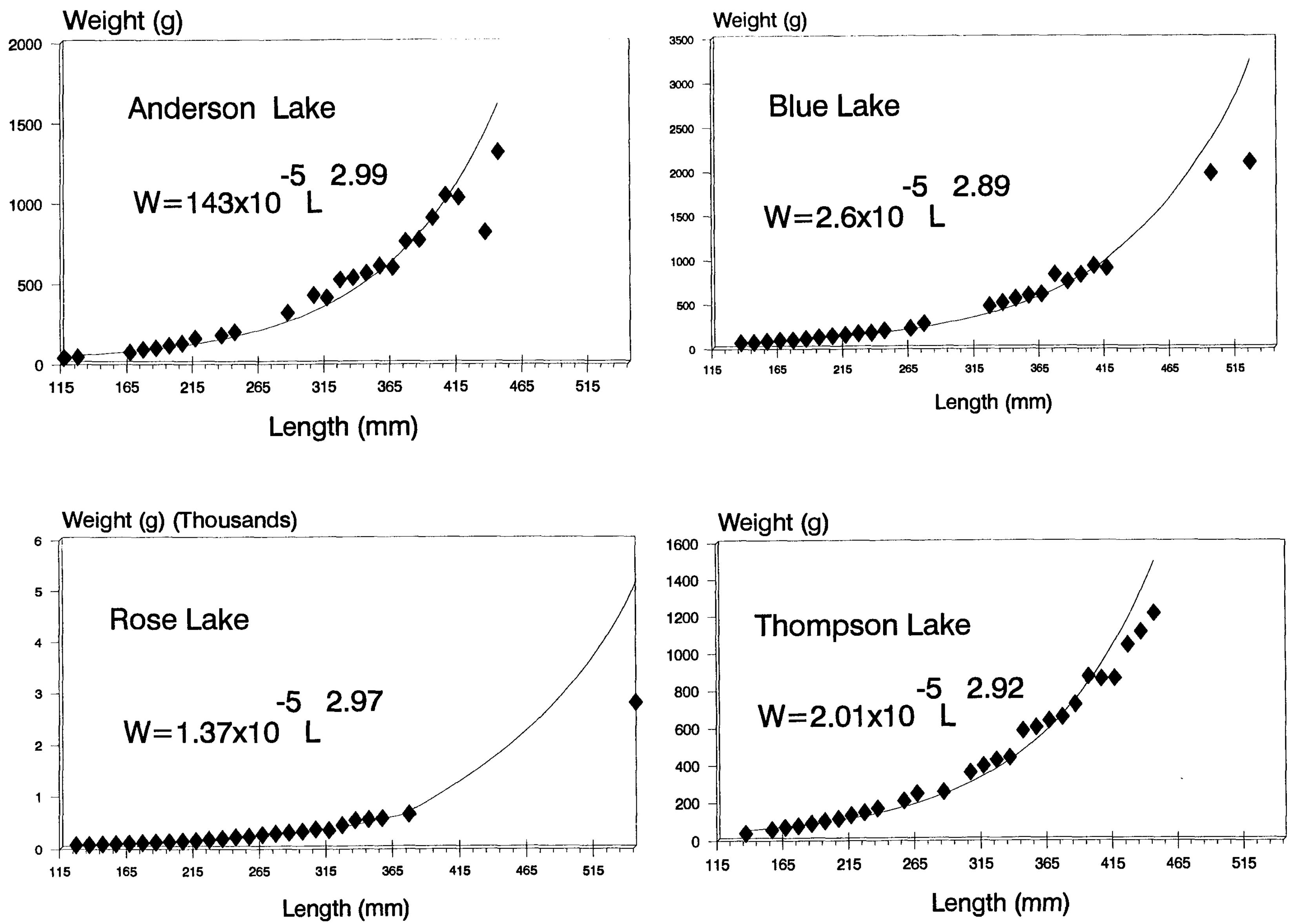

Figure 4. Length/weight relationship for largemouth bass collected by electrofishing in Anderson, Blue, Rose, and Thompson lakes, Idaho, 1990.

Table 4. Summary of weighted mean length-at-annulus (mm) for largemouth bass from selected north Idaho lakes, 1990.

Lake	I	II	II	IV	V	VI	VII	VIII	IX
Anderson	82	180	263	320	360	383	410	--	--
Blue	76	169	245	310	341	372	--	--	--
Rose	81	159	223	279	312	343	360	--	--
Thompson	81	159	22[illegible]	29[illegible]	346	378	408	427	430

DISCUSSION

Rose Lake has been managed under the statewide general bass regulations of 305 mm (12 inch) minimum harvest length, open year-round, and five bass in possession since 1984. Anderson and Thompson lakes have been managed under a 356 mm (14 inch) minimum harvest length, five bass in possession, and a July 1 through December 31 harvest season since 1984. Blue Lake was managed the same as Anderson and Thompson lakes prior to 1990. In 1990, the fishing regulations on Blue Lake were changed to year-round catch-and-release for bass. The special regulations were put into effect on Anderson, Thompson, and Blue lakes to produce a trophy fishery.

The special regulations have produced more larger fish in Anderson, Thompson, and Blue lakes than in Rose Lake (Figure 2). The length frequencies indicated a strong recruitment potential in all the lakes surveyed. However, there was a group of bass present in Rose Lake in the 245-305 mm range that were not as abundant in Anderson, Thompson, and Blue lakes (Figure 2). Recruitment potential may be better in Rose Lake than the other three lakes. Rose Lake is not influenced by runoff events in the Coeur d'Alene River (fluctuating water levels, cold temperatures, turbid water) that may influence bass recruitment in lakes that are connected directly to the river by boat channels.

PSD was used to evaluate the composition of a bass population by comparing stock size bass to quality size bass in different parts of the country. Anderson (1980) reported largemouth bass PSD values for the mid-west states range 40 to 70. Paragamian (1982) reported PSD values of 31 to 50 as optimum in Iowa. Modde and Scalet (1985) reported optimum largemouth bass PSD values in Montana range from 12 to 26. Rieman (1983) reported actual PSD values for Thompson and Anderson lakes of 61 and 93, respectively. The PSD values in 1990 for Thompson, Blue, Anderson, and Rose lakes ranged from 32 in Rose Lake to 83 in Anderson Lake (Table 2). Although these were good PSD values, the lowest value in Rose Lake was probably due to the lower minimum harvest length for bass than in the other three lakes. The high PSD in Anderson Lake may be artificially high due to stockpiling of large bass. There have been tournaments in Coeur d'Alene Lake and the chain lakes system for over 12 years. . We have required bass clubs to redistribute bass brought in for the weigh-in. A disproportionate number of bass have been relocated to Anderson, Thompson, and Blue lakes due to their closeness to the weigh in site and protection these regulations offer to bass. The optimum PSD values for north Idaho lakes have not been established, but the range measured on these four lakes, 32 to 83, probably encompasses the optimum values.

Modde and Scalet (1986) cautioned against fishery managers trying to attain high PSD values similar to other parts of the country because a decrease in the production of quality size bass may result. Optimum PSD values were based on the productivity of the lake.

Instantaneous mortality (Z) was highest in Rose Lake (Z=0.56) and lowest in Blue Lake (Z=0.33), which was expected because of the different regulations; Rose Lake was the most liberal and Blue Lake was the most restrictive. In 1981, Rieman (1983) reported a Z value, using catch curves, in Thompson Lake of 0.48, and in 1990, we reported a value of 0.40 using catch curves indicating a slight decrease in mortality, probably due to the more restrictive bass fishing regulations.

The overall age structure for Thompson and Blue lakes was similar (Figure 5). Ages 1 to 4 comprised 73% of the largemouth bass collected and aged. In Anderson Lake, age 1-4 fish comprised 58% of the population, illustrating the suspected stockpiling of larger fish by tournament anglers. Rose Lake had the highest percentage of age 1-4 fish, 86%, indicating harvest of older age fish (Figure 5). Rieman (1983) reported that age 1 -4 comprised 85% of the largemouth bass collected in Thompson Lake in 1981. In 1990, this percentage was 73%. This was another indication that the restrictive regulations have provided more older and larger largemouth bass.

Growth of largemouth bass in the four lakes surveyed was best in Anderson and Blue lakes and poorest in Rose Lake (Table 4). Comparison of largemouth bass growth in several other north Idaho lakes revealed that bass in Anderson, Blue, and Black lakes are reaching 305 mm at age 4, whereas that length is not reached until age 5 or 6 in most other lakes (Tables 4 and 5). Rieman (1983) reported similar back-calculated lengths in Blue and Thompson lakes in 1981 as in 1990 (Table 6). This was an indication that relative length of bass had remained similar. However, condition factors appear to have decreased as density of longer fish increased. In 1981, Rieman (1983) reported a length-weight relationship for largemouth bass in Thompson Lake of W=3.18 x 106L3.26, and we calculated a length-weight relationship for largemouth bass in Thompson Lake in 1990 of W=2.01 x l0"5L2.92 (Figure 6). A recalculation of the Rieman equation using July data only and bass over 200 mm in total length was represented by W=1.02 x $10^{-6}L^{3.45}$ A similar recalculation of the 1990 data for bass over 200 mm collected in late September and early October was represented by W=9.28 x 10- 6L3.os The differences begin for bass greater than 300 mm and weight increased as total length for largemouth bass increased (Table 7; Figure 7). This difference was significant at the 95% confidence interval (CI).Increased density of larger fish was the most likely cause of the reduced condition.

It appears that the minimum length limit for largemouth bass has increased the abundance of quality sized bass, but with a trade-off of poorer condition. The trophy regulations (356 mm minimum length for harvest) has produced a trophy fishery in Thompson and Anderson lakes. There were more bass over 400 mm in these lakes than in Rose Lake. It was too soon to evaluate the bass population response to catch-and-release fishery in Blue Lake.

RECOMMENDATIONS

1. Maintain current regulations on Anderson, Thompson, and Blue lakes to continue the trophy bass fishery.

2. Maintain current regulations on Rose Lake to continue the general bass fishery.

3. Include in the bass research program the determination of optimum PSD values for north Idaho lakes.

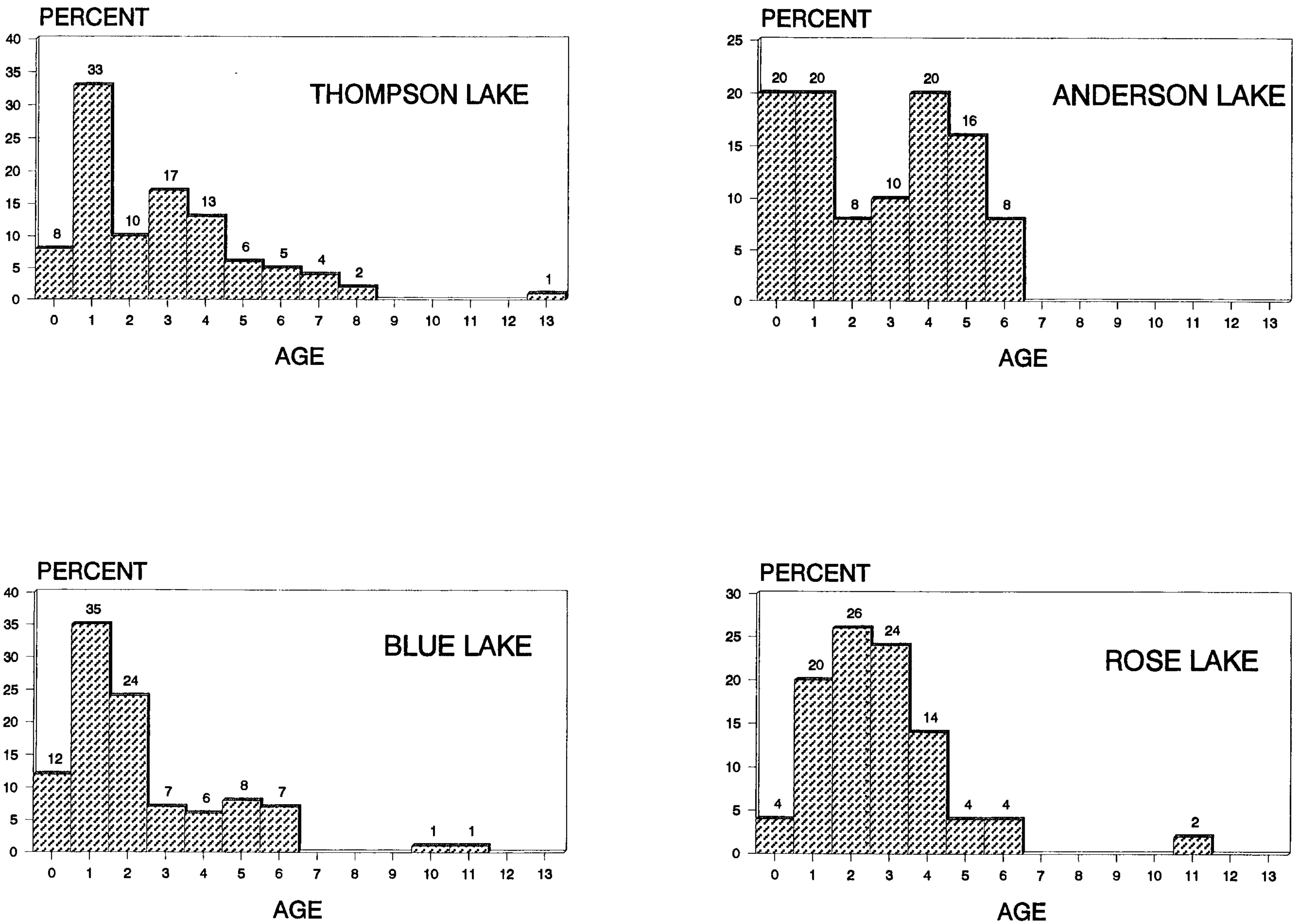

Figure 5. Percent age frequency of largemouth bass collected by electrofishing in Thompson, Anderson, Blue, and Rose lakes, Idaho, 1990.

Table 5. Summary of weighted mean length-at-annulus (mm) for largemouth bass from north Idaho lakes, 1989-1990[a].

Lake	I	II	III	IV	V	VI	VII	VIII	IX
Robinson	65	129	201	265	308	346	387	426	446
Perkins	72	146	212	273	316	346	382	420	426
Hauser	67	119	159	196	224	251	288	327	347
Smith	70	137	191	210	237	253	--	--	--
Fernan	67	136	194	249	299	343	381	411	437
Upper Twin	72	128	176	224	331	393	432	432	455
Black	71	165	238	328	384	429	449	466	483

[a]Data collected by Jeff Dillon, Research Biologist, IDFG.

Table 6. Weighted mean length-at-annulus (mm) for largemouth bass from Thompson and Blue lakes, 1981 and 1990.

Location	Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Thompson	1981	69	139	212	277	325	372	408	440	466	482	509	525	590
	1990	83	183	215	275	337	372	410	433	430	--	--	--	---
Blue	1981	72	150	231	304	363	411	469	491	523	535	--	--	--
	1990	76	169	245	310	341	372	--	--	--	--	--	--	--

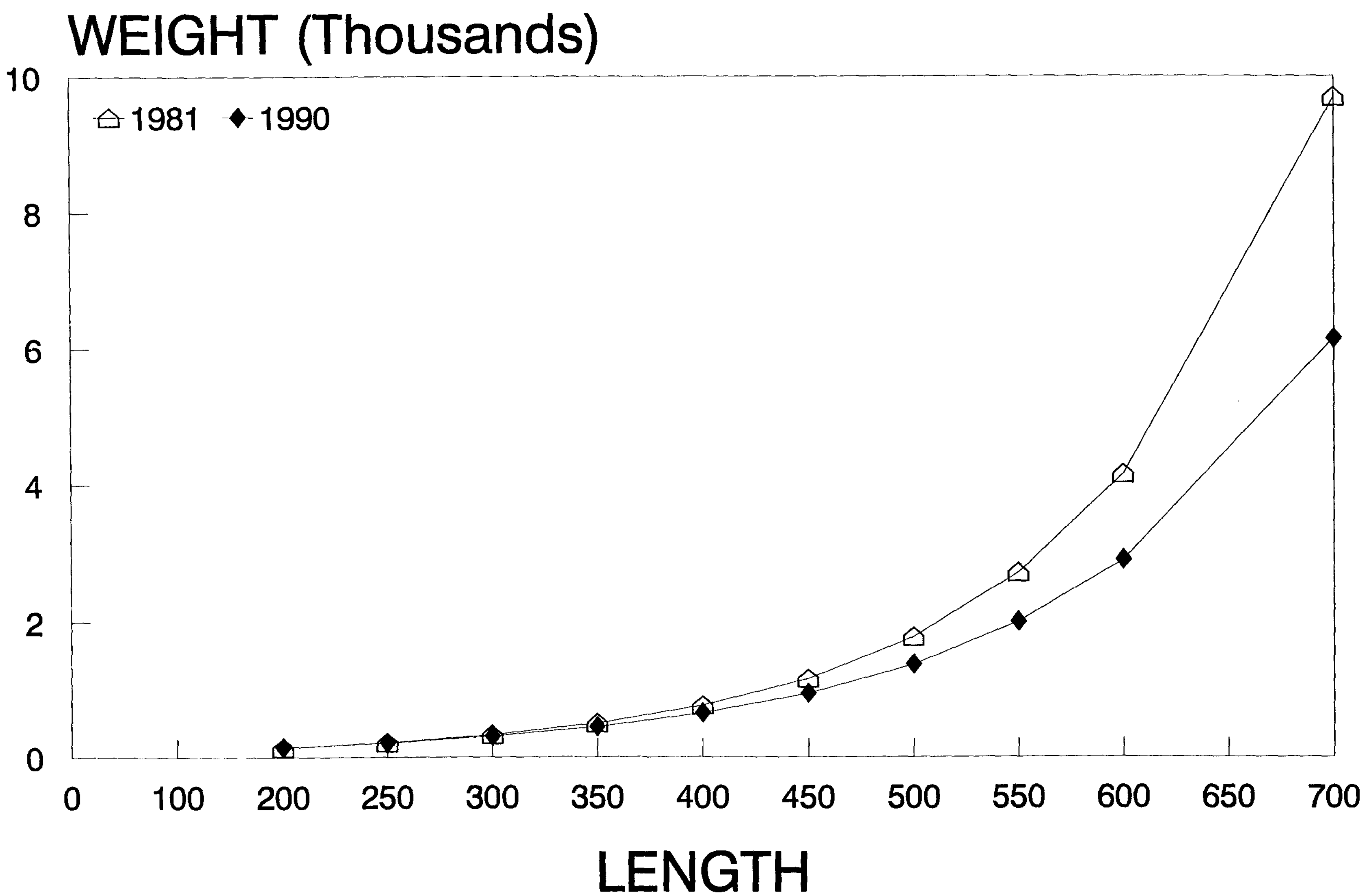

Figure 6. Length/weight relationship of largemouth bass collected from Thompson Lake, Idaho, by electrofishing, July 1981 and October 1990.

Table 7. Differences in calculated weights generated from length-weight relationships developed in Thompson Lake using largemouth bass 200 mm or longer collected by electrofishing, July 1981 ($W=1.02 \times 10^{-6}L^{3.45}$) and September 1990 ($W=9.28 \times 10^{-6}L^{3.05}$)

	Weight (g) at length (mm)									
Year	200	250	300	350	400	450	500	550	600	700
1981	89	191	359	610	968	1,453	2,090	2,903	3,919	6,671
1990	97	191	333	533	801	1,148	1,583	2,117	2,760	4,417
Difference	-8	0	26	77	167	305	507	786	1,159	2,254

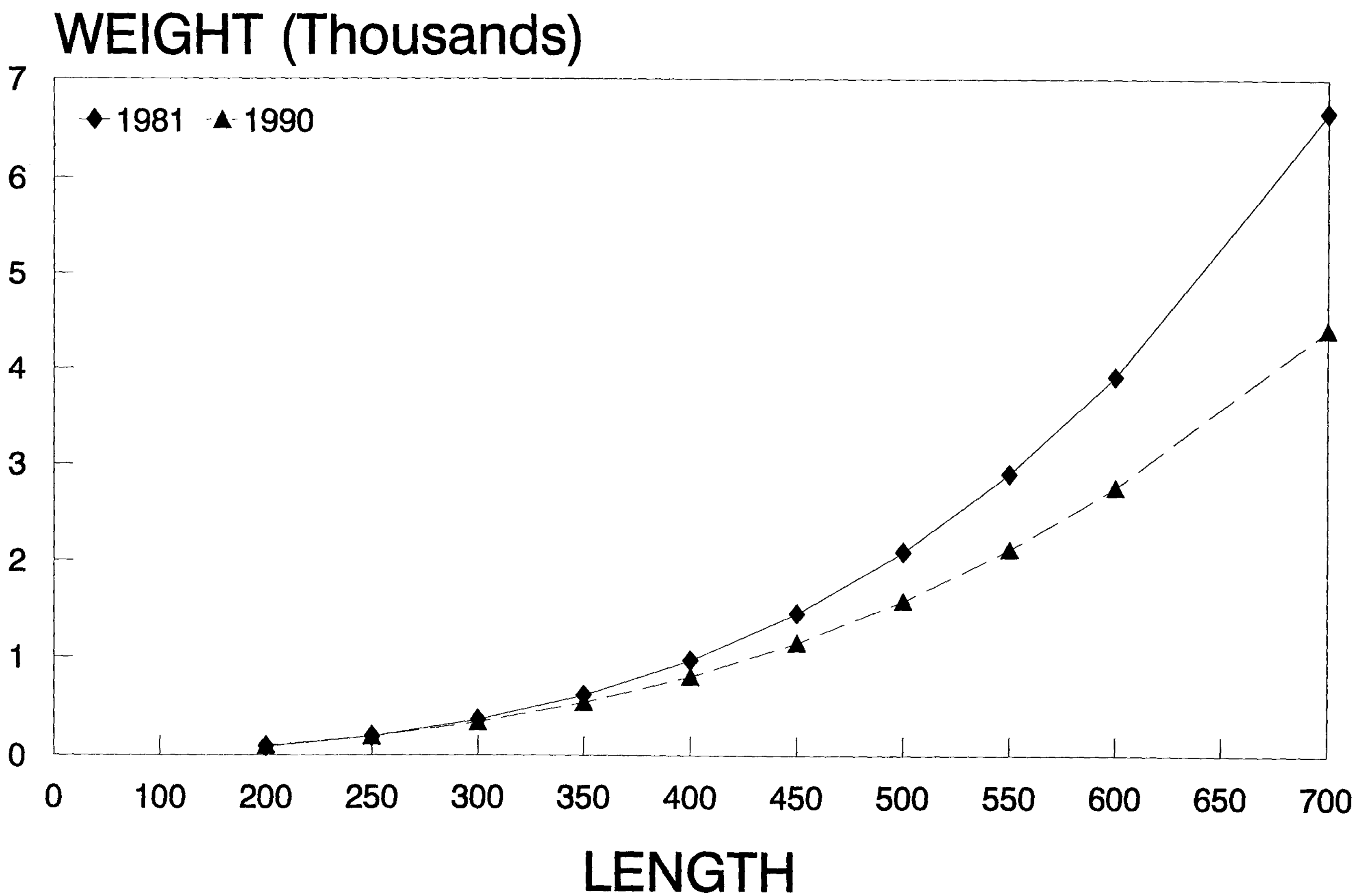

Figure 7. Comparison of weights calculated from the length/weight equations (1981 - $W=1.02 \times 10^{-6} L^{3.45}$, 1990 - $W=9.28 \times 10^{-6} L^{3.05}$) developed from largemouth bass over 200 mm collected from Thompson Lake, Idaho, by electrofishing in July 1981 and October 1990.

LITERATURE CITED

Anderson, R.O. 1980. Proportional Stock Density (PSD) and relative weight (W): interpretive indices for fish populations and communities. In S. Gloss and B. Schupp (Ed) Practical Fisheries Management: more with less in 1980's. Workshop Proceedings 27-33. New York Cooperative Fish Research Unit, Cornell University, Ithaca.

Chapman, D.G., and D.S. Robson. 1960. The analysis of a catch curve. Biometrics 16(3):354-368.

Modde, T., and C.G. Scalet. 1985. Latitudinal growth effects on predator-prey interactions between largemouth bass and bluegill in ponds. North American Journal of Fisheries Management 5:227-232.

Modde, T., and C.G. Scalet. 1986. Latitudinal influences upon largemouth bass and bluegill interactions in small impoundments. In R.M. Stroud (Ed) Fish Culture in Fisheries Management. Symposium Proceedings 201-207. American Fisheries Society. Bethesda, Maryland.

Paragamian, V.L. 1982. Catch rates and harvest results under a 14.0-inch minimum length limit for largemouth bass in a new Iowa impoundment. North American Journal of Fisheries Management 2:224-231.

Rieman, B.E. 1982. Lake and Reservoir Investigations, Largemouth Bass Investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Project F-73-R-4, Job Performance Report, Boise.

Rieman, B.E. 1983. Lake and Reservoir Investigations, Largemouth Bass Investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Project F-73-R-5, Job Completion Report, Boise.

Rieman, B.E. 1984. Lake and Reservoir Investigations, Largemouth Bass Exploitation in Northern Idaho. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Project F-73-R-6, Job Completion Report, Boise.

Rieman, B.E. 1987. Fishery and Population Dynamics of Largemouth Bass (Micropterus salmoides) in select Northern Idaho Lakes. PhD Thesis, University of Idaho, Moscow.

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No.: F-71-R-15

Title: Region 1 Lowland Lakes Investigations

Job No.: 1-b[2]

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

In Priest Lake, 100,000 adipose-clipped westslope cutthroat trout *Oncorhynchus clarki lewisi* were stocked at various locations in the southern end of the lake. Regulations were adjusted to allow harvest of fin-clipped fish. One hundred and fifty subcatchable cutthroat trout were tagged with $5 reward Floy tags, but none of these tags have been returned. A total of 96 lake trout *Salvelinus namaycush* were tagged during April 1990. The density of Mysis shrimp *Mysis relicta,* sampled in June 1990, was 53 shrimp/m^2 ±23 (95% confidence interval) which represented a significant decline in mysid abundance since 1989.

Mid-water trawling for kokanee salmon *O. nerka kennerlyi* was conducted in Spirit Lake during July 1990. Population estimates for age 0, age 1, age 2, and ages 3 and 4 were 149,266, 399,200, 112,217, and 90,254, respectively. This continued the increasing trend in kokanee salmon abundance in Spirit Lake.

Bull trout *Salvelinus confluentus* redds were counted in several tributaries to Lake Pend Oreille. A total of 510 redds were counted in six tributaries during October 1990. This number represented a 6% decline from 1989 totals, but was 13% higher than in 1987. Twenty-three bull trout were collected and spawned to begin a hatchery program; 33,850 eggs were collected.

A total of 28,841 westslope cutthroat trout were raised in net pens on Lake Pend Oreille and released. An additional 70,210 that were raised at Clark Fork Hatchery were stocked into the lake. Two hundred forty net pen raised cutthroat trout were tagged with $5 reward Floy tags.

A total of 67 largemouth bass *Micropterus salmoides* and 2 smallmouth bass *M. dolomieu* were collected and 17 largemouth bass were tagged with $5 reward Floy tags in Hayden Lake. Exploitation of largemouth bass tagged in 1990 was 35%.

Jewel Lake was electrofished for 27 minutes and 150 trout were caught. Mean length of the cutthroat x rainbow hybrids and the westslope cutthroat trout was 265 mm and 262.4 mm, respectively. Growth rate of trout in the newly renovated lake was 175 mm for hybrid trout and 117 mm for the westslope cutthroat trout over a 7-month period. Westslope cutthroat trout were more abundant in our electrofishing sample than cutthroat x rainbow hybrids.

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PRIEST LAKE

Introduction

Priest Lake (9,450 hectares) has undergone dramatic changes in species composition since the early 1900s. Bull trout Salvelinus confluentus and westslope cutthroat trout Oncorhvnchus clarki lewisi were the only native sport fish in the lake. By the 1950s, cutthroat trout abundance had been greatly reduced, and most of the sport fishery was for kokanee O. nerka kennerlyi that were introduced in the 1940s (Bjornn 1957). The introduction of Mysis shrimp Mysis relicta in 1965 helped the lake trout population expand by increasing juvenile survival, but negatively affected kokanee abundance. Mid-water trawling was discontinued in 1990 when kokanee stocking was terminated. Also this year, subcatchable cutthroat trout were stocked to determine if a consumptive fishery could be reestablished.

Cutthroat Trout

Methods, Results, and Discussion

A total of 100,000 2-year-old westslope cutthroat trout from the Clark Fork Hatchery were stocked at ten locations around the southern half of Priest Lake. All of these trout were adipose fin-clipped. One hundred fifty of these trout were marked with $5 reward Floy tags to estimate return-to-the-creel and evaluate the stocking program. The tag series was A-351 to A-500. Tags were selectively put on the largest 600 of the cutthroat trout and, therefore, may tend to overestimate the percentage of tags returned. Mean length of tagged fish was 169 mm (range - 141 mm to 199 mm).

None of these tags were returned during 1990. Since the fish were less than 230 mm, the average size catchable trout are usually stocked, it will likely be 1991 until harvest of these fish reaches its full potential. We recommend tagging an additional 300 cutthroat trout in 1991 to further evaluate this program.

Lake Trout

Methods, Results, and Discussion

A lake trout Salvelinus namaycush tagging program was started in 1990 in an attempt to document exploitation. In the past, fishermen tagged fish prior to releasing them. We started our own tagging program to avoid problems due to releasing them. We started our own tagging program to avoid problems due to poor data collection and reporting.

On May 15, 16, and 17, 1990, we gillnetted 142 lake trout. White $5 reward Floy tags (series A-242 to A-340) were put on 96 fish. Twenty of these fish had the swim bladder punctured with the tagging gun to assist their resubmersion. Forty-six trout died during the gillnetting, even though nets were only set for 20 to 60 minutes. Netting locations were near Bartoo Island, Pinto Point, and West Twin Island. Most nets were set in excess of 30 m of water.

Only three tags were returned in 1990. Mauser (1988) found that return rates of lake trout increased after the first year, so it was too soon to calculate meaningful exploitation rates. The program should continue for 3 to 4 years before good exploitation rates can be calculated. Nighttime shallower water gillnetting should be tested in 1991 to see if netting mortality can be reduced. Growth rates of tagged lake trout were quite slow, ranging from no growth to 90 mm/year (Figure 1).

Mysis Shrimp

Methods

Mysis shrimp were sampled at night during the new moon phase on June 6, 1989 and June 22, 1990. Ten samples were collected during 1989 and eight in 1990. Sampling locations were chosen at random. Shrimp were collected with a Miller high-speed sampler equipped with a General Oceanics flowmeter and a 130-micron plankton net and bucket. Stepped oblique tows were made from 46 m to the surface, sampling for 10 s at each 3-m step. The sampler was towed approximately 1.5 m/s and raised 0.5 m/s with an electric winch. Mysis from each sample were counted and sexed by 1 mm size group. Density estimates were based on volume of water filtered and 95% confidence intervals (CI) were calculated using a Student's t test.

Results

A total of 118 shrimp were collected in 10 samples in 1989. The shrimp population was estimated at $192/m^2$ ± 74 (95% CI). Eighty-six percent of the population were juveniles (young-of-the-year) and 14% *were* immature adult and mature adult shrimp (1- and 2-year-olds) (Figure 2).

Only 24 shrimp were collected in eight samples in 1990. The shrimp population was estimated at 53 shrimp/m^2 ± 23 (95% CI). Fifty-eight percent of the shrimp were juveniles and 42% were immature adults and mature adult shrimp (Figure 3).

Discussion

The decline in mysid density from 1989 ($192/m^2$) to 1990 ($53/m^2$) was of concern. To put this estimate in perspective, Lake Pend Oreille has averaged 1,536 shrimp/m^2 (29 times as many) over the last five years. This change in Priest Lake mysid density was statistically significant and, thus, was not a reflection of sampling precision. If this change was real (and not a reflection of sampling bias) then shrimp were at a very low population level.

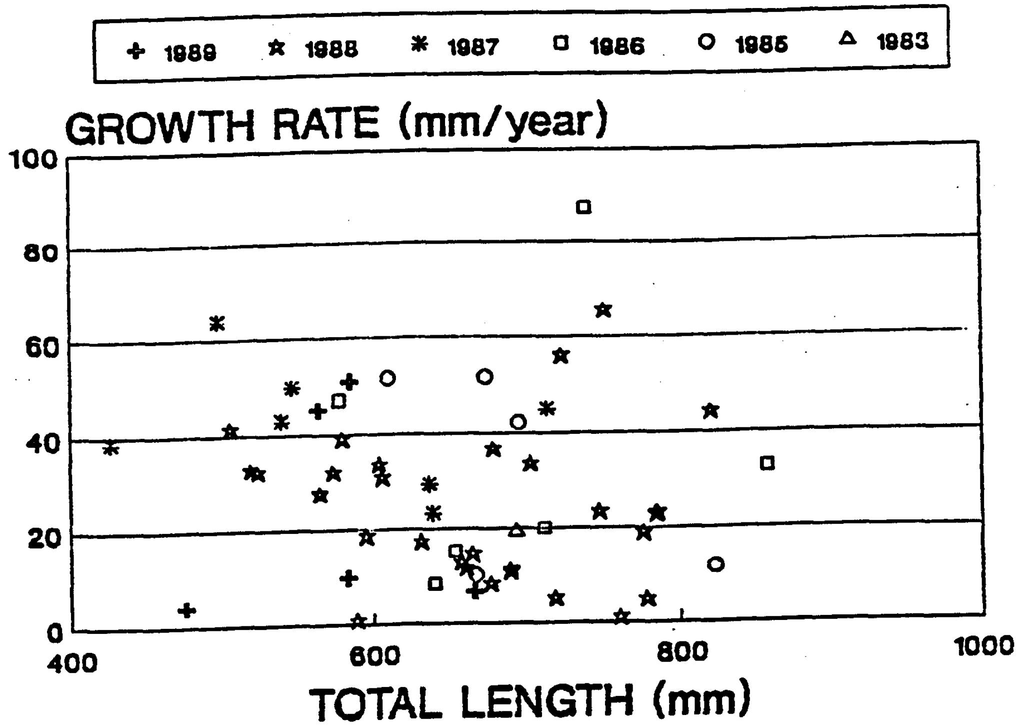

Figure 1. Growth rates of tagged lake trout in Priest Lake, Idaho.

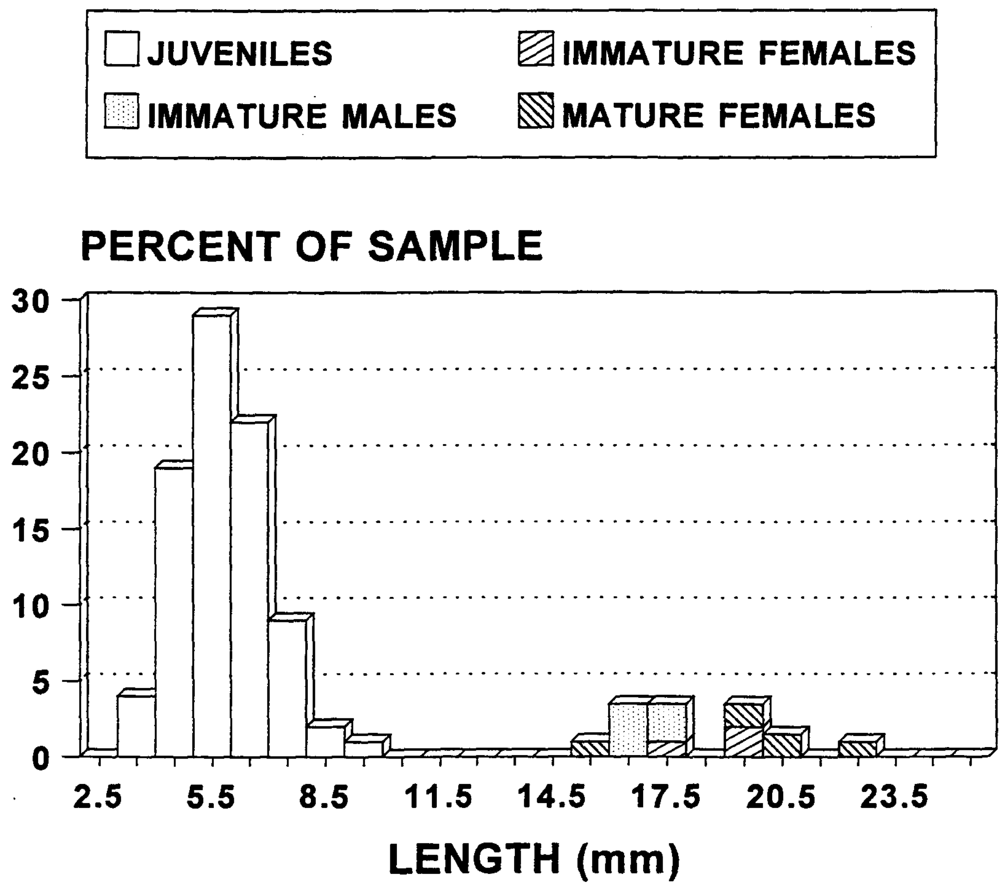

Figure 2. Size distribution of Mysis shrimp collected at standardized locations from Priest Lake, Idaho, on June 6, 1989.

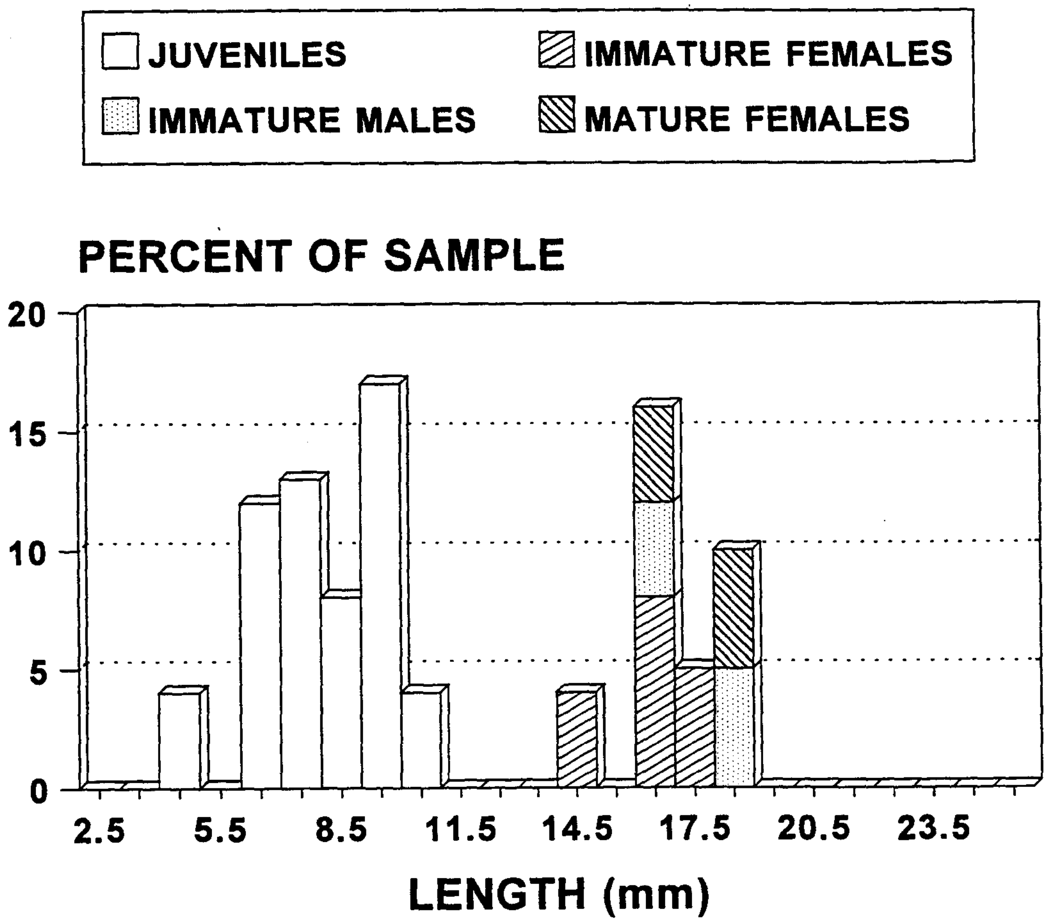

Figure 3. Size distribution of Mysis shrimp collected at standardized lcoations from Priest Lake, Idaho, on June 22, 1990.

In 1989, only 14% of the population were older-age shrimp. Gregg (1976) estimated about 50% of the relatively stable shrimp population in Twin Lakes, Colorado were juveniles during summer. The paucity of older-aged shrimp may indicate heavy lake trout predation on mysids. This hypothesis is also supported by the resulting low shrimp population estimate in 1990.

The Department has been evaluating additional forage species which would prey on shrimp and would be food for larger lake trout. Considering the apparently low shrimp population, stocking forage at this time may be inadvisable.

SPIRIT LAKE

Introduction

Spirit Lake (526 hectares) was a two-story fishery of both salmonid and spiny-ray fish in 1990. Kokanee and put-and-take rainbow trout O. mvkiss supported most of the fishing effort. The kokanee fishery of Spirit Lake was considered to be one of the best in the region because of its high yield per hectare. The lake was on general regulations and open year-round. A problem with the fishery was that catch rates were highly variable. This had been attributed to variable densities in kokanee year classes. Since 1984, kokanee fry have been stocked to even out strong and weak year classes by basing stocking rates on age 0 kokanee abundance.

Methods

Trawling methodology and statistical analysis were as described by Bowles et al. (1987). Five trawls were conducted at previously established random locations. Depth sampled ranged from 4.8 m to 15.4 m. Trawling was conducted during the new moon phase on July 20, 1990. The mid-water trawl was towed by an 8.5 m, 140-horsepower diesel engine boat. The net was 13.7 m long with a 3.5-m by 3.5-m mouth. Mesh sizes (stretch measure) graduated from 32, 25, 19, and 13 mm in the body of the net to 6 mm in the cod end. Trawling speed was 1.5 m/s. The vertical distribution of kokanee was divided into 3.5-m layers and a standard 3.5-minute tow was made in each layer, sampling 2,832 m^3 of water over a distance of 315 m. Kokanee were divided into age classes by peaks in the size-frequency distribution.

Results

Population estimates of kokanee in Spirit Lake were 149,266 age 0 (± 28%, 90% error bounds), 399,200 age 1, 112,817 age 2, and 90,254 age 3 and .4 (Figure 4; Table 1). Modal lengths of age 0, 1, 2, and 3 (and older) kokanee were 45 mm, 165 mm, 205 mm, and 240 mm. All kokanee examined over 240 mm were mature and all kokanee under 230 mm were immature.

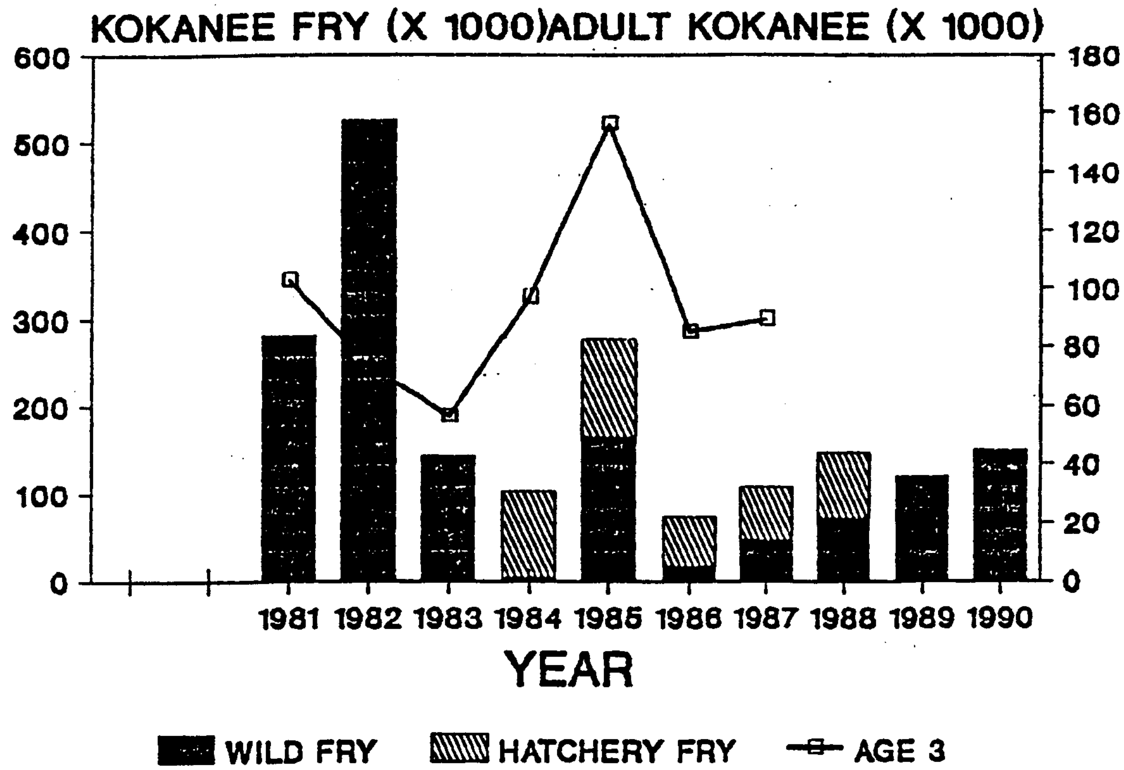

Figure 4. Fry abundance and resulting numbers of adult kokanee in Spirit Lake, Idaho, 1981 to 1990.

Table 1. Estimates of kokanee year classes (1977-1989(made by midwater trawling in Spirit Lake, 1981-1990. Estimates are in thousands of kokanee.

Year Class	Year estimated 1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
1989	149.3[a]									
1988	399.2	120.2[b]								
1987	112.8	130.5	71.1[c]							
1986	90.3	223.2	225.8	46.3[d]						
1985		85.8	92.4	178.7	16.6[e]					
1984			156.3	347.5	287.6	164.4[f]				
1983				97.6	107.9	206.8	3.5[g]			
1982					56.5	113.2	17.4	143.3		
1981						74.3	160.8	272.6	526.0	
1980							103.1	146.8	209.0	281.3
1979								54.2	57.7	73.4
1978									48.0	82.1
1977										92.6
Ages I, II, III, IV	602.3	439.5	474.5	623.8	451.7	394.3	281.3	473.6	314.7	529.4 248.1
Totals	751.6	559.7	545.6	670.1	467.7	558.7	284.8	616.8	840.7	529.4
no/ha	1,312	977	952	1,169	816	975	497	1,076	1,467	924

Mean no/ha = 985

[a]No stocking in 1990.
[b]No stocking in 1989.
[c] 75,000 kokanee fry released in 1988.
[d] 60,800 kokanee fry released in 1987.
[e] 57,142 kokanee fry released in 1986.
[f] 109,931 kokanee fry released in 1985.
[g] 100,000 kokanee fry released in 1984.

Discussion

Abundance

From 1984 to 1988, kokanee fry had been stocked into Spirit Lake to supplement natural fry production. In 1989 and 1990, no fry were stocked. Total abundance of kokanee, even without supplemental stocking, has remained quite high. This year's total abundance estimate of 752,000 kokanee was the highest since 1982 (Table 1). Age 0 kokanee were the most variable segment of the population estimate. Even if they were not included in the totals, kokanee abundance was still the second highest on record. Thus, the cessation of stocking has not reduced kokanee abundance.

Predictions for the kokanee fishery for the next three years appeared quite good. Age 3 fish, which will form the bulk of the 1991 fishery, should be in fairly typical abundance. Outlook for the fishery in 1992 and 1993 should also be quite good as back to back strong year classes work through the population.

An increasing trend in kokanee abundance was noted in Spirit Lake in 1989 which fit the regression equation $y = 28.594 x -56353$, where y was the abundance estimate of age 1 through 4 kokanee, and x was the year (Maiolie et al. 1991). Data from 1990 again fit this increasing trend. This trend may be due to increased productivity of the lake caused by nutrient loading. If so, the amount of nutrient loading was substantial since carrying capacity for kokanee has doubled in about 10 years. This change should be considered a warning sign and the nutrient loading problem should be investigated.

To date, we have not determined to what extent strong and weak year classes affect the fishery. Rieman and Meyers (1990) documented increased kokanee size and increased vulnerability to angling gear with lower kokanee densities. Thus, weak year classes may still provide good catch rates of large fish. We, therefore, recommend correlating catch rates and kokanee densities in Spirit Lake to determine if there are any benefits of our stocking program. We also recommend not stocking kokanee in a year with a weak year class to gather the needed information.

LAKE PEND OREILLE

Introduction

Lake Pend Oreille (38,300 hectares) is the largest natural lake in Idaho, as well as the deepest (351 m). Starting in 1988, a new regulation went into effect restricting harvest to one rainbow trout over 61 cm. Bull trout could still be harvested at a rate of two per day with no size limit. These new regulations may have persuaded fishermen to target bull trout as a consumptive fishery. Our objective was to determine if this additional effort will cause overexploitation of the bull trout population as measured by spawner abundance.

Methods

Bull trout redd surveys have been conducted on tributaries to Lake Pend Oreille each fall since 1983 and served as an index of adult abundance (Pratt 1984 and 1985; Hoelscher and Bjornn 1987). Similar methodology was also used by Graham et al. (1981), and Fraley et al. (1981). The 1990 surveys were conducted on Trestle Creek (October 9), Johnson Creek (October 17), East Fork Lightning Creek (October 17), Gold Creek (October 18), North Gold Creek (October 18), and Grouse Creek (October 16). These dates were consistent with the schedule used by Pratt (1985); September 20 to October 26. Redds were defined as an area of exceptionally clean gravel with a tail or mound of loose gravel downstream from a depression. In areas where redds appeared to be superimposed, the number of distinct depressions was counted. Bull trout spawning escapement was estimated by multiplying the number of redds by 3.9 fish/redd, as was used by Pratt (1985, 1985) and Hoelscher and Bjornn (1987), and calculated by Fraley et al. (1981). The entire length of creeks where redds had been reported in the past (Hoelscher and Bjornn 1987) were walked in 1990.

Results

A total of 510 redds were counted in six tributaries (Table 2). Trestle Creek had the highest number of redds (218) and East Fork Lightning Creek the lowest (29). Total number of redds was down 6% from 1989 and up 13% from 1987. It is, however, lower than in 1983, 1984, or 1985. Based on 3.9 fish/redd, an estimated total of 1,989 adult bull trout entered these tributaries.

Ten female and 13 male bull trout from Gold Creek were collected and spawned for the hatchery program. Adults were then returned to the creek. A total of 33,850 eggs were collected.

Discussion

Bull trout were a "species of special concern" as designated by the State of Idaho. Their populations have been severely reduced statewide, and many populations were lost or reduced to the point that they cannot sustain a fishery. Lake Pend Oreille was the only place in the State that had a popular fishery with a significant amount of harvest. During 1985, creel surveys estimated a total of 621 bull trout were harvested (Bowles et al. 1987). Considering these facts, it was imperative to closely monitor this apparently fragile fishery.

Redd counts served as a relative index of the adult bull trout population. The last two year totals of 543 and 510 redds were well below the totals seen in the early 1980s and may be an indication the population was declining. It was somewhat difficult to make this conclusion, however, since most of the decline in redd numbers was due to a sharp drop in counts in the East Fork of Lightning Creek. Bedload sediment movement, channel instability, and land slides have all impacted the spawning habitat in this creek. If this loss of habitat was also occurring in other unsurveyed streams, then the bull trout population in the lake may well be in trouble.

Table 2. Number of bull trout redds counted per stream in the Pend Oreille Lake basin, 1983-1990.

Area Stream	Total number of redds							
	1983[a]	1984[a]	1985[b]	**1986[b]**	1987	1988	**1989**	1990
CLARK FORK RIVER								
Lightning Creek	28	9	46	14	4			
Spring Creek	0	-	0	-	-			
East Fork	110	24	132	8	59	79	100	29
Savage Creek	36	12	29	-	0			
Char Creek	18	9	11	0	2			
Porcupine Creek	37	52	32	1	9			
Wellington Creek	21	18	15	7	2			
Rattle Creek	51	32	21	10	35			
Johnson Creek	13	33	23	36	10	4	17	33
Twin Creek	7	25	5	28	0			
NORTHERN SHORE								
Trestle Creek	298	272	298	147	230	244	217	281
Pack River	34	37	49	25	14			
Rapid Lightning Creek	0	-	0	-	-			
Grouse Creek	2	108	55	13	56	24	50	48
Hellroaring Creek	0	-	4	-	-			
Jeru Creek	0	-	0	-	-			
EASTERN SHORE								
Granite Creek	3	81	37	37	30			
Sullivan Springs	9	8	14	-	6			
North Gold Creek	16	37	52	8	36	24	37	35
Gold Creek	131	124	111	78	62	111	122	84
Total of the six streams counted in 1988	570	598	671	290	453	486	543	510

[a] Data from Pratt 1985.
[b] Hoelscher and Bjornn 1988.

We would recommend surveying additional streams in 1991. Porcupine Creek, Rattle Creek, Granite Creek, and the Pack River would be likely sites if additional manpower could be obtained.

NET PEN CUTTHROAT TROUT CULTURE

Results and Discussion

During 1990, four net pens were used to raise 38,841 westslope cutthroat trout in Pend Oreille Lake. (An additional 70,210 cutthroat trout were stocked directly from the Clark Fork Hatchery.) Cutthroat trout were put into the net pens in October and released in May. Two hundred and forty $5 Floy tags (series A-1 to A-240) were inserted into the dorsal musculature of 60 fish from each net pen. Mean size of the net pen cutthroat trout was 160 mm at release. Only two of the tags were returned; one reared and caught in Garfield Bay and one reared at Bayview and caught in the Pend Oreille River. Exploitation was therefore 0.841T at this very premature date. Most of these fish should be recruited to the fishery during the summer of 1991.

HAYDEN LAKE

Introduction

Hayden Lake is being managed as a quality fishery for both warmwater and coldwater species. As such, special regulations were placed on trout, bass, and crappie. Hayden Lake is near a major population center which increased the risk of overexploitation of fish stocks even with the restrictive regulations. Tagging studies were conducted beginning in 1989 to evaluate the exploitation of largemouth bass. In addition, length information was gathered on smallmouth bass to determine if they have recruited to the fishery since their initial introduction into the lake in 1983-1985.

Methods

On the night of June 11, 1990, the north end of Hayden Lake was electrofished to determine length frequency composition and place reward tags on legal size (>56 mm) largemouth bass. Blue $5 reward Floy tags (series R-56 to R-75) were inserted below the dorsal fin of 17 bass. Species, length, and on legal sized bass, weight were recorded.

Results

A total of 67 largemouth bass and 2 smallmouth bass were collected. Yellow perch, bullheads, pumpkinseeds, tench, cutthroat trout, rainbow trout, and crappie were also caught. Seventeen tags were placed in legal sized largemouth bass that ranged from 360 mm (685 g) to 516 mm (2,100 g).

During 1990, seven tagged largemouth bass were caught by anglers and six were harvested. Six of the caught bass had been tagged in 1990 and one was tagged in 1989. Six of these bass were caught by just two local (Hayden, Idaho) anglers. To date, 40 largemouth bass have been tagged, 6 harvested (15%), and 1 released (2.5%).

Discussion

Size frequency distribution did not indicate that bass were being "cropped-off" at the legal size limit (356 mm). A sudden drop in bass frequency did, however, occur at 470 mm (Figure 5). Possibly, anglers have been conditioned by five years of catch-and-release regulations, to return large bass, but were harvesting any bass over 470 mm. This self-imposed limit may have increased the number of bass between 356 mm and 460 mm.

The regulation appeared to be working; allowing the harvest of some bass but still preserving a good size structure. Exploitation of bass tagged in 1990 was 35%, which would be sufficient to change the abundance of trophy size bass. If increased abundance of larger bass is desired, catch-and-release regulations or larger size limits may accomplish this.

JEWEL LAKE

Introduction and Methods

Jewel Lake was rotenoned during the fall of 1989 to remove a population of stunted perch. During the spring of 1990, it was restocked with pure fingerling westslope cutthroat trout, Henrys Lake cutthroat x rainbow hybrids, and kokanee fry. Electrofishing was conducted on November 6, 1990 to determine the relative frequency and growth of both strains of trout.

Results

In 17 minutes of electrofishing, we collected 27 cutthroat x rainbow hybrids, 118 westslope cutthroat trout, 1 kokanee, and 5 unknown smaller trout which appeared to be stunted hybrids (Figure 6). Catch rate was 8.8 trout/min with our electrofishing gear.

Mean size of hybrid trout was 268 mm ± 6 mm (95% CI). The westslope cutthroat trout were not significantly different at a size of 267 mm ± 2 mm (95% CI). No perch were collected.

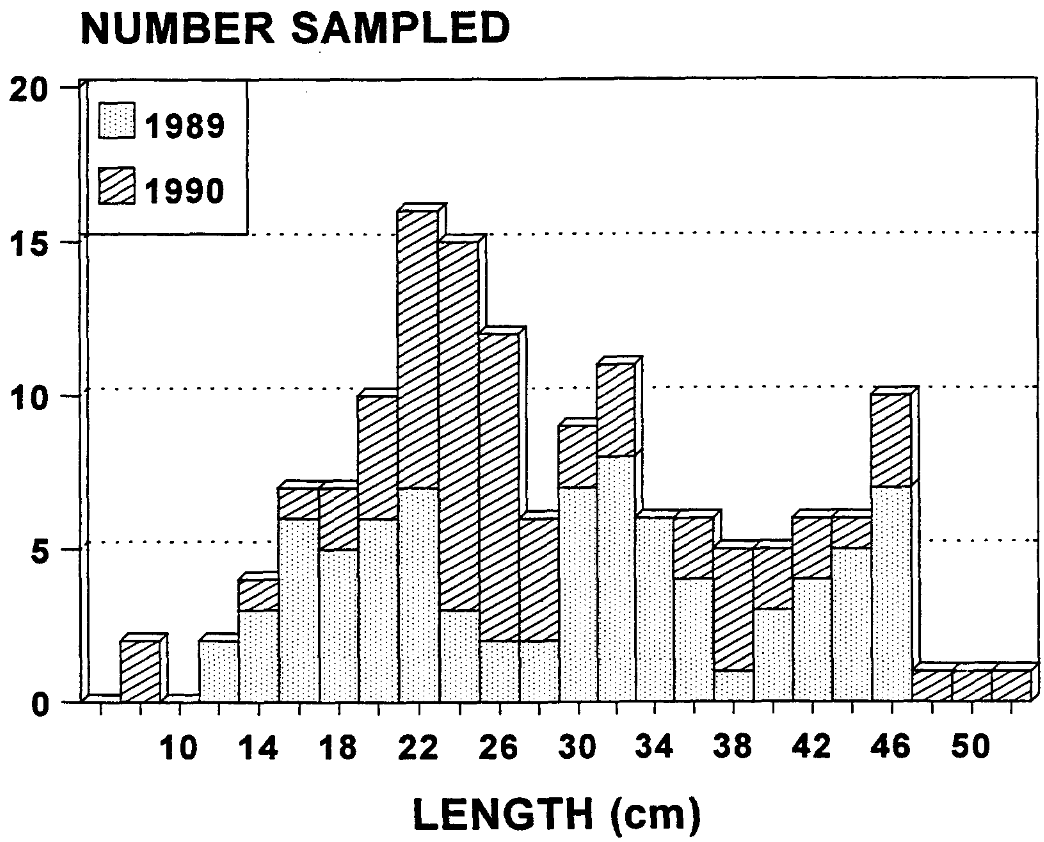

Figure 5. Lengths of largemouth bass sampled by electrofishing in Hayden Lake, Idaho, during June 1989 and 1990.

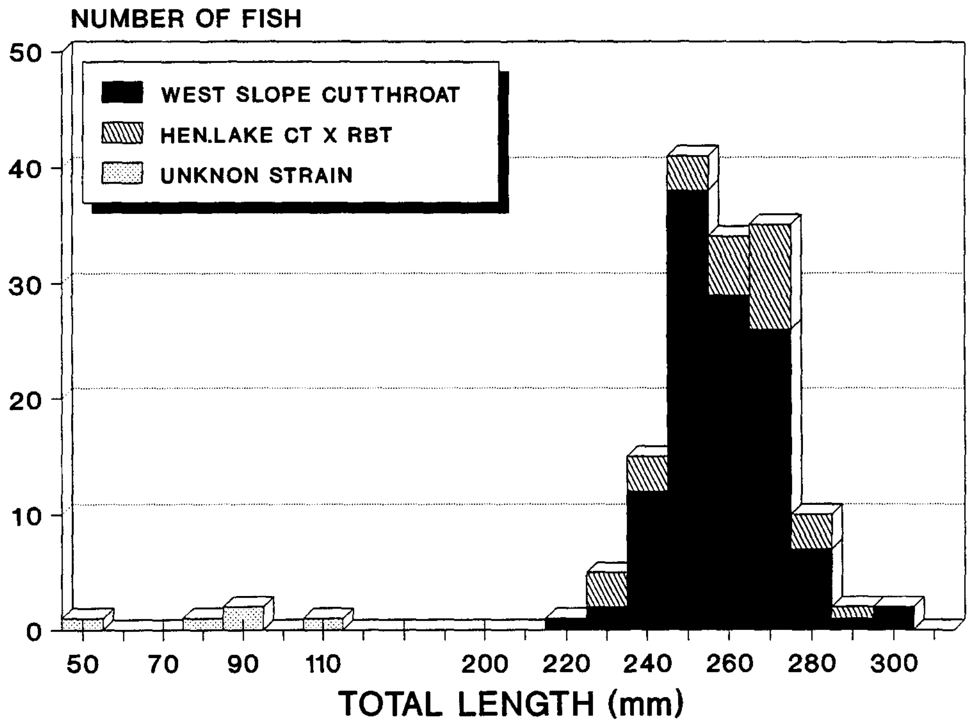

Figure 6. Length of two different strains of trout sampled from Jewel Lake, Idaho, November 6, 1990.

Discussion

The mean length of rainbow x cutthroat hybrid trout when stocked on March 27, 1990 was 90 mm. The westslope cutthroat trout were stocked on April 10, 1990 at an average length of 145 mm. The hybrid trout grew an average of 175 mm in 221 days (7.3 months) for an average growth of 24 mm/month. The westslope cutthroat trout grew 118 mm in 210 days (7 months) for an average growth rate of about 17 mm/month. Both species of trout should enter the fishery (356 mm minimum harvest length) by mid-season in 1991.

LITERATURE CITED

Bjornn, T.C. 1957. A survey of the fishery resources of Priest and Upper Priest lakes and their tributaries. Idaho Department of Fish and Game, Job Completion Report, Project F-24-R, Boise.

Bowles, E.C., V.L. Ellis, D. Hatch, and D. Irving. 1987. Kokanee stock status and contribution of Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho. Idaho Department of Fish and Game, Job Performance Report, Project 85-399, Boise.

Fraley, J.J., D. Reed, and P. Graham. 1981. Flathead River study - 1981. Montana Department of Fish, Wildlife, and Parks, Helena.

Graham, P.J., B.B. Shepherd, and J.J. Fraley. 1981. Use of stream habitat classifications to identify bull trout spawning areas in streams. In: Acquisition and utilization of habitat inventory information: Proceedings of the symposium (October). Wester Division, American Fisheries Society. p. 186-190.

Gregg, R.E. 1976. The ecology of *Mysis relicta* in Twin Lake, Colorado. M.S. Thesis. Colorado State University, Fort Collins. 171 p.

Hoelscher, B., and T.C. Bjornn. 1987. Habitat, densities of trout and char, and potential production in Pend Oreille Lake tributaries. Idaho Department of Fish and Game, Job Completion Report, Project F-71-R-10, Subproject III, Job No. 8, Boise.

Maiolie, M., J. Davis, and N. Horner. 1991. Regional fisheries management investigations. Idaho Department of Fish and Game, Job Performance Report, Project F-71-R-14, Job No. 1-b, Region 1 Lowland Lakes Investigations, Boise.

Mauser, G.R., R.W. Vogelsang, and C.L. Smith. 1988. Fishery enhancement in large north Idaho lakes. Idaho Department of Fish and Game, Study Completion Report, Project F-73-R-10, Subproject III, Study III, Job 2, Boise.

Pratt, K.L. 1984. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise.

Pratt, K.L. 1985. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise.

Rieman, B.E., and D. Meyers. 1990. Status and analysis of salmonid fisheries - kokanee population dynamics. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-12, Subproject II, Study No. I, Job Nos. 1,2,3, Boise.

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No.: F-71-R-15

Title: Region 1 Rivers and Streams Investigations-Northern Squawfish Control Effort

Job No.: 1-c[1]

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

A weir and trap were placed in the St. Maries River on June 20, 1990 at river flow 15.5 m^3/s (550 cfs). This was the highest river flow that we were able to wade safely. Placement of the weir on this date was too late to capture the upstream spawning migration of northern squawfish *Ptychocheilus oregonensis.*

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INTRODUCTION

In recent years, considerable public concern has been expressed about the large number of northern squawfish Ptvchocheilus oreqonensis in the St. Joe and St. Maries rivers. The northern squawfish is a native cyprinid in northern Idaho which has evolved with native salmonids such as westslope cutthroat trout Oncorhvnchus clarki lewisi, bull trout Salvelinus confluentus, and mountain whitefish Prosopium williamsoni. Squawfish are opportunistic feeders, their diets consisting of aquatic insects, oligochaetes, crayfish, and fish (Falter 1969; Reid 1971; Beamsderfer 1983). MacPhee and Reid (1971) believed that any reduction in the number of squawfish should increase the abundance of food items available to preferred species.

In addition to competing for food, squawfish may also compete with game fish species for spawning and rearing space (Jeppson and Platts 1959). More recent research, however, indicated competition between squawfish and salmonids was minimal (Brown and Moyle 1981).

Reid (1971) determined squawfish in the St. Joe River typically began their upstream spawning migration in April, staging in the slackwater from St. Joe City downstream. They began moving into the fast water reaches above St. Joe City (up to Bluff Creek) in June, reaching peak numbers in late June and early July. During the peak of the spawning run, squawfish were congregated in large schools in the deeper pools (>3.5 m deep) in the river over relatively large substrate (5-10 cm diameter). Water temperature appeared to be the primary stimulus for spawning activity.

Optimum temperature for squawfish spawning was 15°C. Mature fish were not typically found with juveniles (age 0, 1, 2, and 3); the latter most often located in slough or backwater areas in quiet, shallow water over sand or silt substrate.

In the St. Joe River, squawfish seemed to prefer the area below Avery. This preference was attributed to warmer water temperatures, reduced stream gradient, large pools, and the presence of adjacent sloughs and backwater areas for juvenile rearing (Reid 1971). Emigration of squawfish out of the fast water area began in July and continued through September and October, with the majority of fish migrating downstream. Howse (1966) reported large numbers of squawfish in Round Lake in August, and all fish sampled were spent.

Several methods of controlling squawfish were used with varying degrees of success. Gillnetting (Forester and Ricker 1941; Jeppson 1957; Jeppson and Platts 1959), trapping (Hamilton et al. 1970), dynamiting (Jeppson 1957; Keating 1958), electrical barriers or electrofishing (Maxfield et al. 1959), and water level manipulation (Jeppson 1957; Pollard 1972) were tried on numerous bodies of water throughout the northwest. Chemicals were used extensively in the United States since the 1930s to manipulate undesirable fish communities (Gray et al. 1984). Squoxin was successfully shown to be specific for squawfish (MacPhee 1967, 1969) and effective at reducing population levels (Keating et al. 1972; Ortmann 1973; Watson 1973).

In terms of effectiveness and desirability, squoxin would be the clear choice for control of squawfish in the St. Joe and St. Maries river systems.

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However, because squoxin is not a registered piscicide, it has not been available for use since the late 1970s when it was used under an experimental permit. The U.S. Environmental Protection Agency administers the registration of pesticides, and the process is not an easy matter. Data requirements are difficult to meet, must be developed according to specific guidelines, and take substantial amounts of time and money (two to four years and as much as 2.0 million dollars [Rulifson 1984]).

In 1988, a feasibility study was conducted on the St. Joe and St. Maries rivers to determine the effectiveness of various methods of removal on squawfish (Horner et al. 1989). Electrofishing was the most successful method tried. This method has several drawbacks, however. It is labor intensive, has a localized effect, and is ineffective in large, deep pools where squawfish tend to congregate.

In 1990, an attempt was made to block the upstream (spawning) migration of squawfish into the St. Maries River (Figure 1). A temporary weir and trap was used to block the migration. A weir, in some situations, can be used to collect fish. The St. Maries River was selected instead of the St. Joe River because of the lower volume of water present during periods of migration.

OBJECTIVES

Evaluate the potential for blocking the spawning migration of squawfish in the St. Maries River using a temporary weir.

METHODS

The weir was constructed on June 20, 1990, approximately 1 km downstream from the railroad bridge at Lotus (Figure 2). The site consisted of two channels; the main channel 50 m wide and a side channel 15 m wide. Water depth varied from 0.3 m to 1.0 m. The substrate consisted of boulders, cobble, gravel, and sand.

The weir consisted of welded metal frames with two horizontal pieces 3 m long and two vertical pieces 0.6 m long. The frame was made from 5 cm x 5 cm angle iron. Holes, 2.5-cm in diameter, were drilled 1.9 cm apart in the two horizontal pieces of the frame. Metal bars, 2.5-cm outside diameter, electrical conduit 1-m to 1.5-m long were inserted through the holes creating a picket fence. The tripods consisted of three legs made of 5-cm outside diameter steel pipe 2 m long. Wood stringers (14), 10 cm x 10 cm x 5 m, were placed against the tripods for added strength. Eleven tripods were placed in the river, two rows of stringers were wired to the tripods, and the metal frames were then wired to the stringers. The weir in the main channel was angled upstream and had a trap at the apex. The trap was 1.2 m square and 1 m high. The sides of the trap consisted of aluminum grates 1.2 m x 1 m with metal slats 1.3 cm apart. The three grates slid into channels on the top and bottom of the trap. The top and bottom were made from marine grade plywood and cut to 1.2 m square. The trap was held together by 1.2 cm x 10 cm bolts. The downstream side of the trap consisted of 32 pieces of conduit slid through holes on the top and bottom forming a "V" entrance into the trap. The trap and weir were located at the upper end of the island and the weir on the side channel was located at the lower end of the

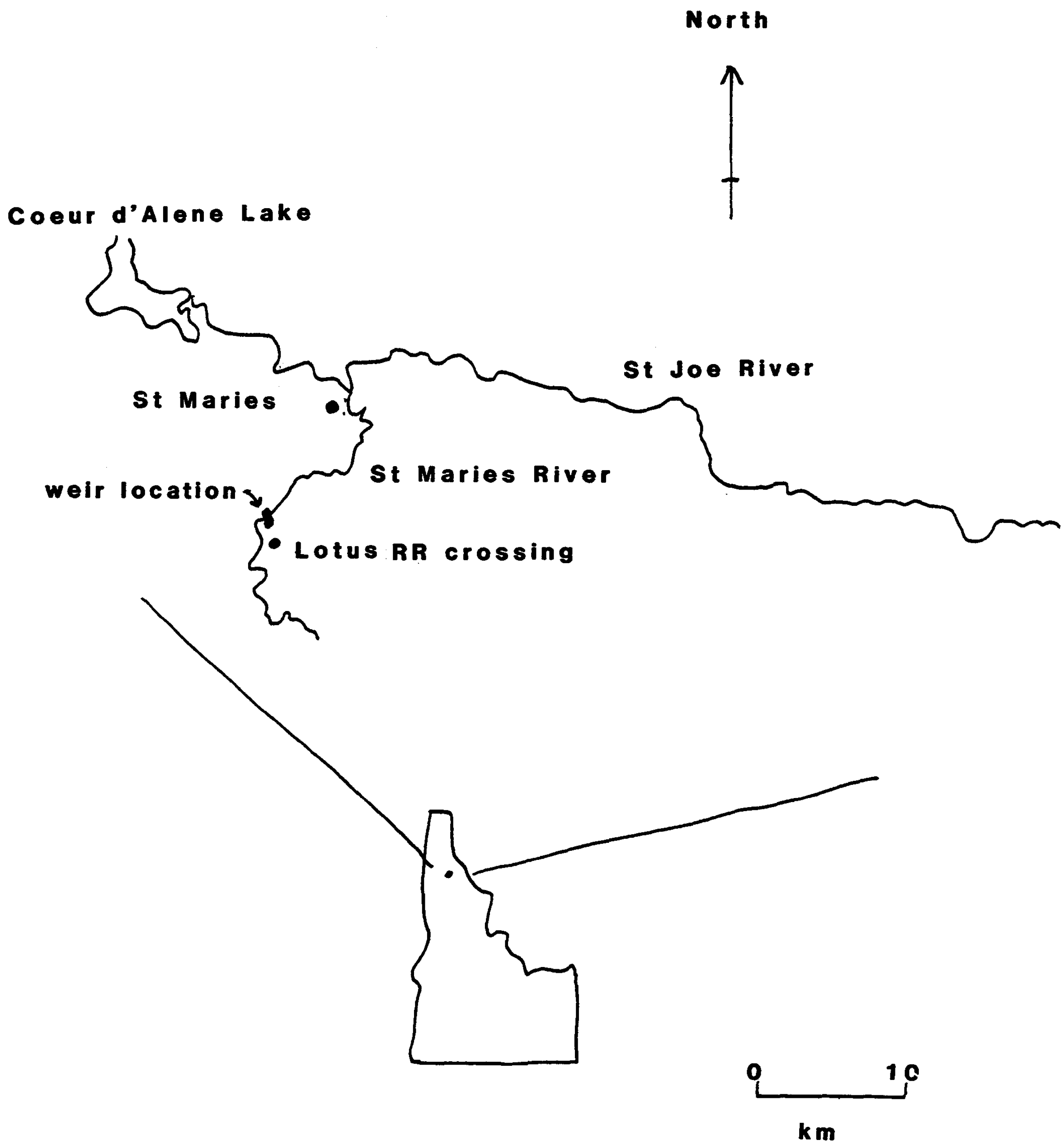

Figure 1. Location of squawfish weir in St. Maries River, Idaho, 1990.

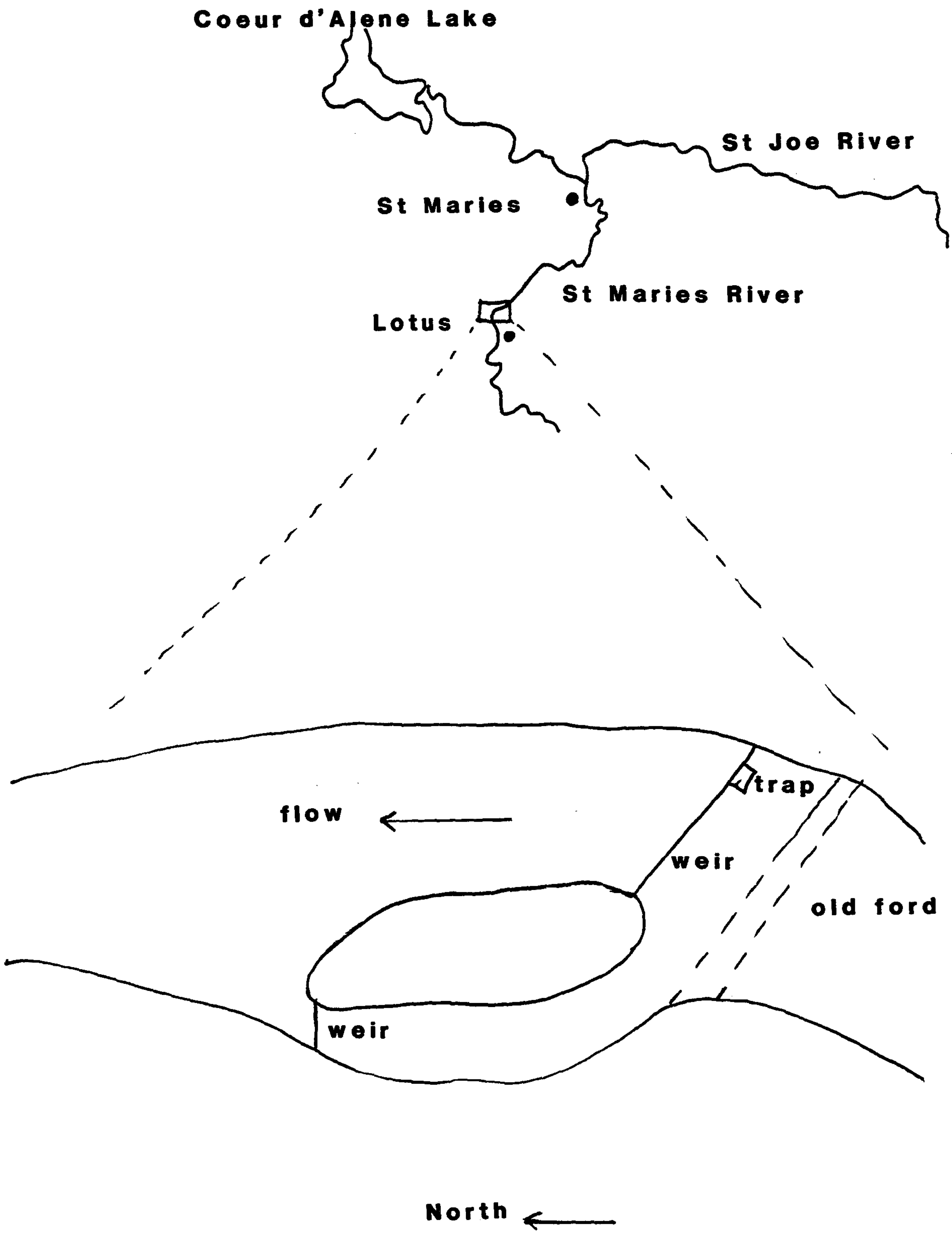

Figure 2. Squawfish weir and trap location on St. Maries River, Idaho, 1990.

island (Figure 2). The side channel weir did not have a trap and directed upstream migrating fish into the main channel.

Trapped game fish species were immediately released upstream. Squawfish were removed and disposed.

RESULTS

Fish were not effectively trapped migrating upstream. The weir in the St. Maries River was not installed early enough to capture upstream migrating squawfish. River flows in excess of 15.5 m^3/s (550 cfs) prevented installation of the temporary weir until June 20, 1990. On June 22, 1990, six squawfish were removed from the trap, and several hundred squawfish were seen below the weir. The weir was vandalized the week of June 25, 1990, and fish passed through the holes in the weir. No other fish were seen or trapped migrating upstream.

On July 9, 1990, 39 squawfish and 78 suckers *Catostomus macrocheilus* (Table 1) were removed from the upstream side of the weir after being pinned against the pickets. A total of 1,189 squawfish and 2,150 suckers were pinned against the upstream side of the weir and removed. The weir was dismantled on July 30, 1990 after the number of fish being picked off the weir declined to 50 per week.

DISCUSSION

The beginning of the squawfish spawning migration appears to be triggered primarily by increasing water temperatures, beginning in April and peaking in late June or early July. Effective control of squawfish with a trapping operation would need to occur in early spring in the lower river. Unfortunately spring runoff also occurs during the squawfish migration period making it impossible to effectively trap with conventional picket weirs.

We were able to install and operate the squawfish trap in the St. Maries River when flows dropped below 550 cfs. Mean monthly flow in the St. Maries River was less than 550 cfs in 2 out of 11 years in April and 6 out of 11 years in May (Table 2). Although it appears that river flows might allow some trapping of squawfish in the lower St. Maries River prior to squawfish moving upstream, that is not the case in the St. Joe River. The St. Joe River is a much larger system, and discharge during the squawfish spawning migration is too great to operate a picket weir (Table 3).

Construction of a weir capable of trapping migrating squawfish at high flows is technically possible, but economically not feasible under existing budget constraints. A concrete sill would need to be placed on the river bottom and a floating weir capable of trapping upstream migrating fish but allowing debris and downstream migrating fish would be attached to the sill. Cost estimates from salmon weirs operating in Alaska exceed $150,000.

Based on existing research in the St. Joe River, it does not appear that squawfish pose a serious threat to the trout population from either competition or predation. However, they are considered a nuisance by anglers, and reducing the squawfish population would benefit anglers primarily through an increased

Table 1. Number of fish pinned against the upstream side of the weir in the St. Maries River, Idaho, 1990.

Date	Number of fish squawfish	suckers	bullheads
7/9	39	78	6
7/13	187	545	8
7/16	371	446	2
7/19	254	417	1
7/23	216	485	3
7/26	75	103	--
7/30	47	76	--
Total	1,189	2,150	20

Table 2. Mean monthly river flows (cfs) in the St. Maries River, Idaho, during March, April, May, June, and July, 1980-1990.

Year	March	April	May	June	July
1980	421	550	446	473	130
1981	321	579	501	415	166
1982	319	597	504	395	163
1983	1,683	535	562	276	183
1984	1,156	1,001	868	652	163
1985	1,388	1,543	801	394	94.2
1986	1,136	563	395	154	88.3
1987	715	457	272	134	91.8
1988	464	612	286	159	90.1
1989	636	1,305	694	284	92.0
1990	--	1,218	1,352	1,005	--

Table 3. Mean monthly river flows (cfs) in the St. Joe River during March, April, May, June, and July, 1980-1990.

Year	March	April	May	June	July
1980	1,364	5,542	6,845	4,246	1,346
1981	2,112	3,934	5,436	4,436	1,629
1982	3,466	4,464	9,211	6,976	2,110
1983	3,973	3,755	6,990	4,493	1,960
1984	2,622	4,140	6,627	5,854	1,714
1985	1,079	6,067	9,060	5,348	1,146
1986	5,598	4,819	5,202	2,437	840
1987	2,528	5,264	4,816	1,398	643
1988	1,568	5,456	4,554	2,279	865
1989	2,025	7,248	7,173	4,085	1,106
1990	--	7,751	6,044	6,086	--

chance of hooking a game fish. We believe the most realistic and cost effective method for reducing squawfish is to encourage harvest by anglers.

RECOMMENDATION

Encourage and support squawfish derbies by anglers to reduce nuisance populations in a cost effective way.

LITERATURE CITED

Beamsderfer, R.C. 1983. Reproductive biology, early life history and microhabitat of northern squawfish, *Ptvchocheilus oregonensis,* in the St. Joe River, Idaho. Master's Thesis, University of Idaho, Moscow.

Brown, L.R., and P.B. Moyle. 1981. The impact of squawfish on salmonid populations: a review. North American Journal of Fisheries Management 1:104-111.

Falter, M. 1969. Digestive rates and daily rations of northern squawfish in the St. Joe River, Idaho. Doctoral dissertation, University of Idaho, Moscow.

Forester, R.E., and W.E. Ricker. 1941. The effect of reduction of predaceous fish on survival of young sockeye salmon in Cultus Lake. Journal of the Fisheries Research Board of Canada 5:315-336.

Gray, B.A., D.E. Palmer, B.L. Hilton, P.J. Connolly, H.C. Hansel, J.M. Beyer, P.T. Lofy, S.D. Duke, M.J. Parsley, M.G. Mesa, G.M. Sonnevil, and L.A. Predergast. 1984. Feeding activity, rate of consumption, daily rations, and prey selection of major predators in John Day Reservoir. U.S. Fish and Wildlife Service. Prepared for Bonneville Power Administration, Project No. 82-3.

Hamilton, J.A.R., L.O. Rothfus, M.W. Erho, and J.D. Remington. 1970. Use of a hydroelectric reservoir for the rearing of coho salmon. Washington Department of Fisheries Bulletin Number 9, Olympia.

Horner, N.J., M.A. Maiolie, C.A. Robertson. 1989. Regional Fisheries Management Investigations. Idaho Department of Fish and Game. Job Performance Report, Project F-71-R-13, Job 1-c, Boise.

Howse, N.R. 1966. The structure and movement of fish populations in Round Lake, Idaho. University of Idaho, Moscow, 49 p.

Jeppson, P. 1957. The control of squawfish by the use of dynamite, spot treatment, and reduction of lake levels. Progressive Fish Culturist 19(4):168-171.

Jeppson, P.W., and W.S. Platts. 1959. Ecology and control of the Columbus squawfish in northern Idaho lakes. Transactions of the American Fisheries Society 88:197-202.

Keating, J.F. 1958. An investigation of the spawning habits and movements of nongame fish species, particularly squawfish, and evaluation of the findings regarding possible methods of control; a study of applicable methods of controlling nongame fish species; the efficiency and economics involved. Idaho Department of Fish and Game, Job Performance Report, Project F-22-R-4, Boise.

Keating, J.F., O. Kiigemagi, L.C. Terriere, and R. Swan. 1972. Recent developments in the testing of squoxin, a pesticide selectively lethal to squawfish. Pages 609-623 in Proceedings of Fifty-second Annual Conference of Western Association of State Game and Fish Commissioners, Portland, Oregon.

MacPhee, C. 1967. The determination and development of chemicals for the control of undesirable species of fish. Operational Studies Contract 14-17-0001-1564, Columbia River Fisheries Development Program, University of Idaho, Moscow.

MacPhee, C. 1969. The effect of squawfish eradication on trout survival. Pages 209-218 in Proceedings of the Forty-ninth Annual Conference of Wester Association of State Game and Fish Commissioners.

MacPhee, C., and G.E. Reid. 1971. Impact of northern squawfish on survival of fingerling rainbow trout. Idaho Department of Fish and Game, Job Performance Report, Project F-60-R-2, Job 2, Part I, Boise.

Maxfield G.H., K.L. Liscom, and R.H. Lander. 1959. Leading adult squawfish Ptychocheilus oreqonensis within an electric field. U.S. Fish and Wildlife Service, Special Scientific Report--Fisheries Number 298.

Ortmann, D.W. 1973. St. Joe River cutthroat trout and northern squawfish studies. Idaho Department of Fish and Game. Job Performance Report, Project F-60-R-4, Job II, Boise.

Pollard, H.A. II. 1972. Squawfish control in Anderson Ranch Reservoir. Idaho Department of Fish and Game, Summary Report, Project F-53-R-17, Job III-a, Boise.

Reid, G.E. 1971. St. Joe River cutthroat trout and squawfish studies. Idaho Department of Fish and Game, Job Completion Report, Project F-60-R-2, Job 2, Boise.

Rulifson, R.L. 1984. Investigation of the process for registration of squoxin for squawfish control. Final report prepared for Bonneville Power Administration, Project 83-428.

Watson, R.E. 1973. 1973 squoxin (1.1'-methylenedi-2naphthol, sodium salt) application to the Chehalis River System. Mimeo report, Washington Department of Game, Olympia.

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No.: F-71-R-15

Title: Region 1 Rivers and Streams Investigations-Spokane Fishery Evaluation

Job No.: 1-c[2]

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

The rainbow trout Oncorhynchus mykiss population estimates for the Spokane River from Corbin Park in Idaho downstream to Harvard Road in Washington were 2,012 and 1,992, respectively. This represented a significant decline in the Idaho portion of the river since 1986. Exploitation for trout (rainbow and brown trout Salmo trutta) over 356 mm (14 inches) was 13% in Idaho from Post Falls Dam downstream to the state line and 7% from the state line downstream to Sullivan Road in Washington. Idaho anglers expended 6,193 hours and caught an estimated 2,009 fish for catch rates of 0.3 fish/hour. Washington anglers expended 2,844 hours and caught an estimated 781 fish for a catch rate of 0.3 fish/hour.

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INTRODUCTION

The Spokane River has the potential to provide good fishing for anglers. It is located between two major population centers, Spokane, Washington, and Coeur d'Alene, Idaho (Figure 1). Two major studies have been conducted to assess the fish population and the fishery; Bailey and Saltes (1982) and Bennett and Underwood (1988). Bailey and Saltes (1982) covered the river from Post Falls Dam (river km 164.2) to Green Street, Spokane (river km 125.5). Bennett and Underwood (1988) concentrated from Post Falls Dam downstream to the Idaho state line (river km 154.8).

The study conducted in 1990 covered the river from Post Falls Dam down to Sullivan Road, Spokane (river km 141.1). This study had two major goals:

1. Compare the fish populations in Washington and Idaho to determine if fishing regulations affect the abundance and structure of the fish population. Washington fishing regulations on the Spokane River are 1 fish over 203 mm (8 inches) and terminal fishing tackle is restricted to flies and lures only with an opening day of April 28, 1990. In Idaho, there is a 6 fish bag limit, no length restriction, no tackle restriction, and opening day was May 27, 1990.

2. Verify the findings of Bennett and Underwood (1988) relating to exploitation and mortality of fish over 356 mm (14 inches).

OBJECTIVES

1. Determine fishing pressure, harvest, and catch rates in Idaho and Washington.

2. Determine exploitation of trout over 356 mm (14 inches).

3. Estimate the population of trout in Washington and Idaho.

STUDY AREA

The Spokane River begins at the mouth of Coeur d'Alene Lake and empties into the Columbia River. In 1906, a dam was built near Post Falls and inundated the upper 16.8 km of the river. At the dam, the Spokane River drains 958,300 hectares and includes the Coeur d'Alene and St. Joe river drainages. River flows below the dam ranged 14 m^3/s (lowest on record, 1967) to >1,416 m^3/s (highest on record, 1974) (Bailey and Saltes 1982).

The study area covered the section of river from Post Falls Dam to Sullivan Road, Spokane, a total of 23 km (Figure 2). It was divided into two sections; Washington 13.7 km and Idaho 9.4 km (Bailey and Saltes 1982). The study area was restricted to this section for the Spokane River because of the similarity of habitat and water temperatures. Below Sullivan Road, the river receives water from the Rathdrum aquifer which reduces water temperature and increases discharge.

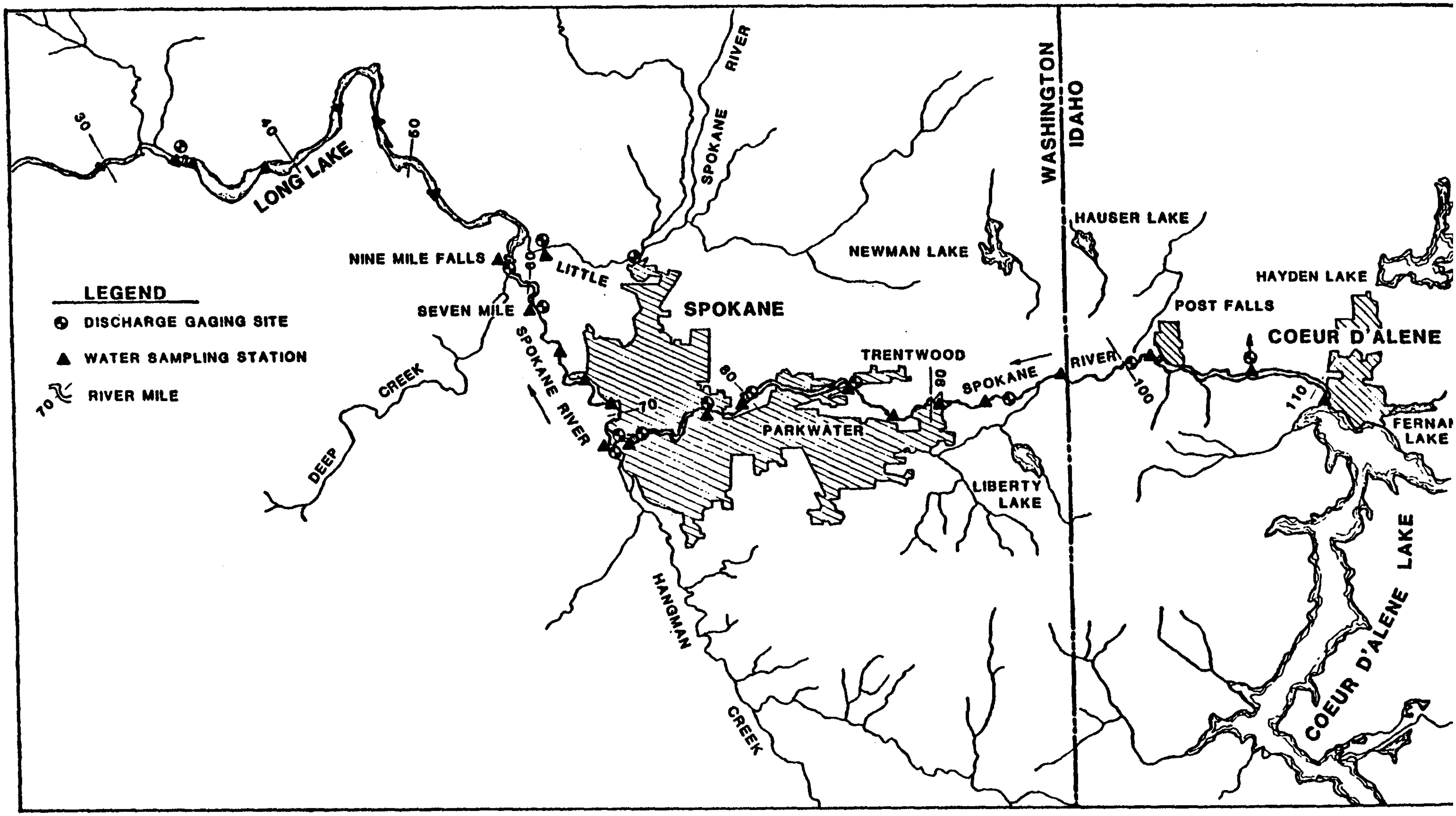

Figure 1. Spokane River from Coeur d'Alene Lake, Idaho, to Long Lake, Washington, 1990.

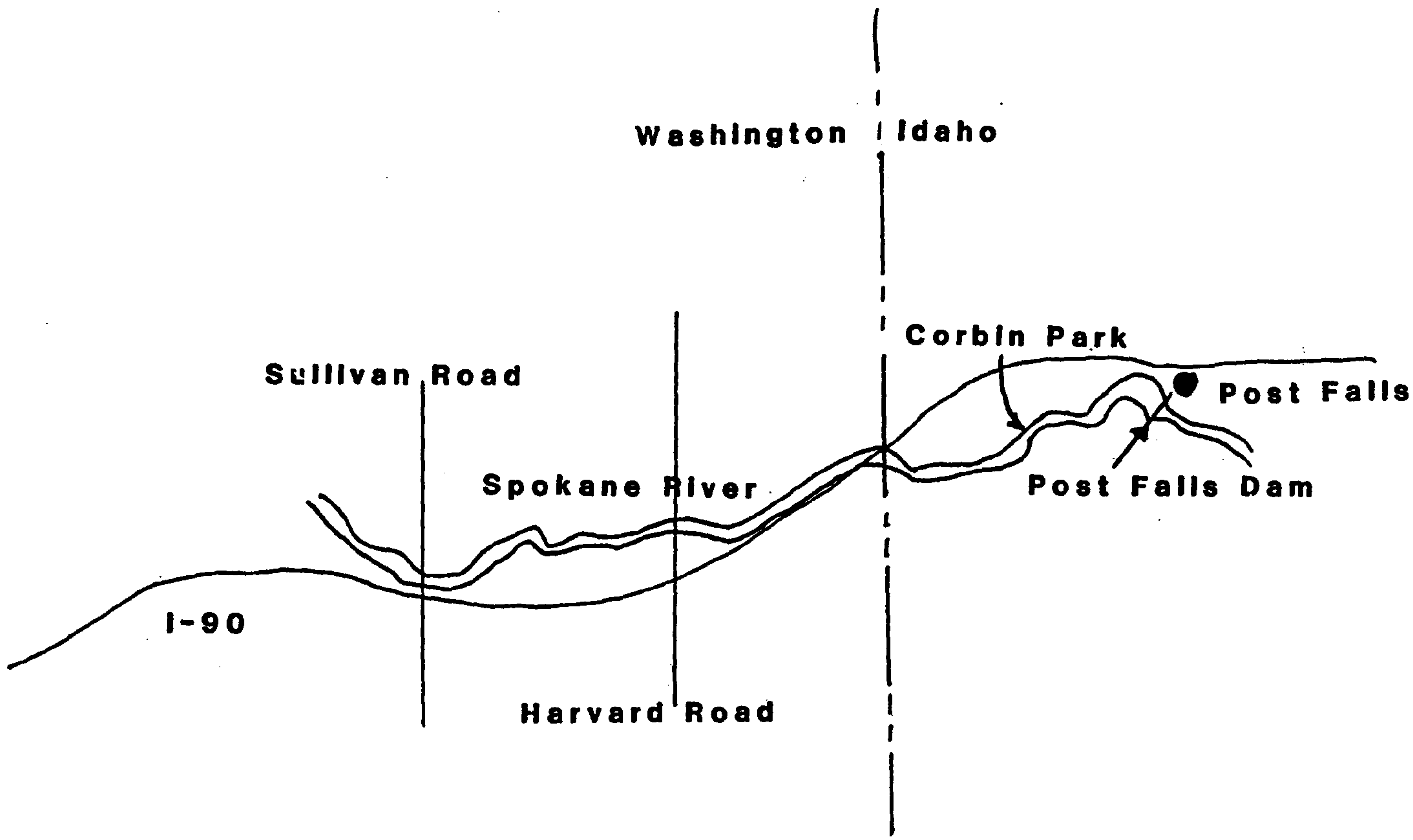

Figure 2. Idaho and Washington Spokane River study areas, 1990.

The creel census portion of the study included the entire 23 km reach in Idaho and Washington. However, the trout population estimate only included the reach from Corbin Park in Idaho downstream to Harvard Road in Washington because boat launches are located at these two sites. The reach from Corbin Park to the state line is 6.1 km and from the state line down to Harvard Road is 5.3 km.

METHODS

The fish were collected by electrofishing in the spring for the tagging/exploitation component of the study and in the fall for the population estimate. An aluminum drift boat modified with electrofishing equipment was used to collect the fish. Two boom-type electrodes, mounted on the bow with a 60 cm diameter hoop and six 60 cm metal cables on each boom were the positive electrodes. The drift boat was the negative electrode. A Coffelt model VVP 2C converted the AC current into pulsed DC current. The voltage was set at 350 volts, which provided the strongest field with minimum injury to the fish. Four flood lights were mounted on the bow to illuminate the netting area. The crew consisted of two netters in the bow of the boat, one of which controlled the on/off foot pedal, and an oarsman who controlled the boat and generator/WP complex.

We launched at dark and drifted downstream along the shoreline. The shoreline was alternated on different nights. Eddys were fished with the current (usually upstream). The duration of the energized field time (EFT, the time electrical current is applied to the water) varied from 30 seconds to several minutes. Stunned fish were netted and placed in a live well. Periodically, we would stop mid-stream and collect data from the captured fish. Data included species length (total mm), weight (g), and scale samples from the first 10 fish per 10 mm length group. Tagging or fin clipping took place at this time.

Exploitation

Fish over 356 mm were tagged with a numbered $5 reward Floy tag on March 26-29, 1990. Exploitation was calculated from the number of tags returned.

Population Estimate

All fish collected during the initial marking period, October 1-12, 1990, were marked with an adipose fin clip. All fish collected during the first of two recapture nights, October 19-20, 1990, were marked with a caudal fin hole punch so they would not be counted again the second night.

A modified Petersen mark and recapture method was used to estimate the trout population in Idaho and Washington (Bennett and Underwood 1988).

$$\hat{N} = \frac{(M+1)(C+1)}{R+1}$$

Where: $\hat{N}$ = population estimate
M = number of fish marked
C = number of fish caught during the recapture run
R = number of recaptures

Variance of $\hat{N}$

$$V\hat{N} = \hat{N}^2 \frac{(\hat{N}-M)(\hat{N}-C)}{MC(\hat{N}-1)}$$

95% Confidence Interval:

$$95\%\ CI\ \hat{N} = \pm 1.96)\ \sqrt{V\hat{N}}$$

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Impressions were made from the collected fish scales. Scales were placed on a 25 mm x 75 mm plastic strips. The strips were placed between two metal plates and inserted into a Carver model C laboratory press. Pressure was increased to 364 kg/cm^2 (20,000 psi) and held for 10 seconds. The number of annuli was counted using an Eberbach Scale Reader and recorded.

Creel Survey

A creel survey was used to collect data to estimate fishing pressure and harvest on the Spokane River from Post Falls Dam downstream to Sullivan Road in Spokane, Washington (Figure 2). The river was divided into two sections; Post Falls Dam to the state line (9.4 km) and the state line to Sullivan Road (13.7 km).

The creel survey period, April 28, 1990 to September 7, 1990 in Washington and May 27, 1990 to September 7, 1990 in Idaho, was divided into ten 2-week intervals. During each interval, each section was sampled on 50% of the weekend days and 20% of the weekdays. Instantaneous angler counts were made four times per survey day. Angler interviews were conducted between counts. Information collected during the interviews included number of anglers per group, total number of hours, number of fish harvested, number of fish released, total number of fish caught, and number of each species harvested.

A computer program designed and developed by Tom McArthur (Idaho Department of Fish and Game, Boise) was used to summarize creel data, estimate fishing pressure and harvest and calculate catch rates for each section during each interval and for the entire census period.

RESULTS

Population Estimate

The estimated number of rainbow trout Oncorhynchus mykiss in Idaho and Washington was similar, 2,012 and 1,992, respectively. Confidence intervals were ± 17% and 19% for Idaho and Washington, respectively (Table 1). Density estimates for rainbow trout were 0.7 fish/100 m^2, or 330 fish/km and 0.4 fish/100 m^2, or 376 fish/km in Idaho and Washington, respectively (Table 2).

The number of brown trout Salmo trutta in each section was 292 and 219 for Idaho and Washington, respectively. The confidence intervals were ± 102 and ± 40 for Idaho and Washington, respectively (Table 1).

Exploitation

A total of 144 tags were put into rainbow and brown trout over 356 mm in Washington (75) and Idaho (69) (Table 3). The exploitation for the tagged fish was 13% and 7%.

Creel Survey

Idaho anglers expended an estimated 6,193 hours to catch an estimated 2,009 fish for a catch rate of 0.3 fish/hour (Table 4). Only 30% of the fish caught were harvested, and rainbow trout were 85% of the fish harvested. Chinook salmon O. tshawytscha, brown trout, and cutthroat trout O. clarki comprised 12%, 1%, and 3%, respectively, of the fish harvested.

Washington anglers expended an estimated 2,844 hours to catch an estimated 781 fish for a catch rate of 0.3 fish/hour. Only 12% of the fish caught were harvested and 55% of the harvested fish were rainbow trout. Brown trout and cutthroat trout comprised 34% and 11%, respectively, of the harvested fish (Table 4).

Population Structure

The combination of age 1, 2, and 3 rainbow trout comprised 94% and 86% of the aged rainbow trout in Idaho and Washington, respectively. The combination of age 1, age 2, and age 3 brown trout comprised 86% and 93% of the aged brown trout in Idaho and Washington, respectively (Table 5). Mean lengths of rainbow trout age 1, age 2, and age 3 in Idaho were 194 mm, 258 mm, and 358 mm, respectively (Table 6). Mean lengths of rainbow trout age 1, age 2, and age 3 in Washington were 201 mm, 276 mm, and 362 mm, respectively (Table 6).

In Idaho, 36% of the rainbow trout over 200 mm were greater than 300 mm (Table 7). In Washington, 50% of the rainbow trout over 200 mm were greater than 300 mm (Table 7). The percentage of brown trout greater than 300 mm in Idaho and Washington was 61% and 25%, respectively (Table 8).

The proportional stock density (PSD) was calculated for rainbow trout and brown trout (Table 9). PSD is the proportion of fish of quality length (300 mm) or trophy length (400 mm) in the population.

Table 1. Population estimates for rainbow trout and brown trout in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road near Spokane, Washington, October 20, 1990.

Species	Location	M+1	C+1	R+1	N	VN	CI	Range
Rainbow trout	Idaho	456	375	85	2,012	30,169	340(17%)	1,672<N<2,352
	Washington	448	298	67	1,992	39,046	387(19%)	1,605<N<2,379
Brown trout	Idaho	53	33	6	292	10,370	102(35%)	190<$\hat{N}$<395
	Washington	70	50	16	219	1,583	40(18%)	179<$\hat{N}$<259
Combined	Idaho	508	407	90	2,297	45,170	417(18%)	1,880<N<2,714
	Washington	517	347	82	2,188	37,761	381(17%)	1,807<N<2,569

Table 2. Density estimates for rainbow and brown trout in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road near Spokane, Washington, October 20, 1990.

Location	Length (km)	Mean width (m)	Area (m^2)	N		Fish/100 m^2		Fish/km	
				Rb	Bn	Rb	Bn	Rb	Bn
Idaho	6.1	46	280,600	2,012	292	0.7	0.1	330	48
Washington	5.3	69	365,70	1,992	219	0.4	0.05	376	41

Table 3. The number of tags returned and exploitation of fish caught in the Spokane River from Post Falls Dam, Idaho down to the Idaho/Washington state line and from the state line down to Sullivan Road near Spokane, Washington, 1990.

Location	Number of tags		Number of tags returned		Exploitation percentage		
	rainbow	brown	rainbow	brown	rainbow	brown	combined
Idaho	47	22	8	1	17.0	4.5	13.0
Washington	65	10	4	1	6.2	10.0	7.0

Table 4. Estimated angler hours, total fish caught, and catch rates per section for the survey period (April 28, 1990 to September 7, 1990) on the Spokane River from Post Falls Dam, Idaho down to the Idaho/Washington State line and from the state line down to Sullivan road near Spokane, Washington.

Section	Hours fished	Number of fish harvested	released	caught	C/R	Rb	Bn	Ct	Bk	Ck
1 (Idaho)	6,193	623	1,332	1,955	0.3	528	5	18	0	72
± at 95% CI	854	260	91	306		236	9	28	0	86
2 (Washington)	2,844	92	690	782	0.3	50	31	10	0	0
± at 95% CI	613	97	485	516		44	83	22	0	0
Total	9.037	714	2,022	2,736	0.3	578	36	28	0	72
± at 95% CI	1,051	277	493	600		240	84	36	0	86

Rb = rainbow trout
Bn = brown trout
Ct = cutthroat trout
Bk = brook trout Ck =

Table 5. Number and percentage of aged rainbow and brown trout collected by electrofishing in the Spokane River in 1990 from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road near Spokane, Washington.

		Ages									
		1		2		3		4		5	
Species	Location	n	%	n	%	n	%	n	%	N	%
Rainbow trout											
	Idaho	15	10	76	50	52	34	6	4	2	1
	Washington	21	21	41	41	24	24	9	9	5	5
Brown trout											
	Idaho	1	2	23	52	14	32	2	5	4	9
	Washington	2	3	48	80	6	10	4	7	0	0

Table 6. Mean length of aged rainbow and brown trout in the Spokane River, 1990, from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road near Spokane, Washington.

Species	Location	Mean lengths (mm)				
		age 1	age 2	age 3	age 4	age 5
Rainbow trout						
	Idaho	194	258	358	397	410
	Washington	201	276	362	410	413
Brown trout						
	Idaho	195	267	381	528	502
	Washington	243	265	401	430	

Table 7. Percent composition of various length groups of rainbow trout collected by electrofishing in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road in Spokane, Washington, 1990.

Length (mm)	Idaho n	Idaho %	Washington n	Washington %	Both n	Both %
>200	433	100	405	100	838	100
200-299	277	64	202	50	479	57
300-399	144	33	179	44	323	39
400-499	12	3	24	6	36	4
500 and up	0	0	0	0	0	0

Table 8. Percent composition of various length groups of brown trout collected by electrofishing in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road near Spokane, Washington, 1990.

	Idaho		Washington		Both	
Length (mm)	n	%	n	%	n	%
>200	51	100	68	100	119	100
200-299	20	39	51	75	71	60
300-399	9	18	8	12	17	14
400-499	18	35	9	13	27	23
500 and up	4	8	0	0	4	3

Table 9. Proportional stock densities for rainbow trout and brown trout collected by electrofishing in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/Washington state line and from the state line down to Harvard Road in Spokane, Washington, 1990.

	Idaho		Washington	
Length (mm)	n	PSD	n	PSD
Rainbow trout				
200 and up	433		405	
300 and up	156	36	203	50
400 and up	12	3	24	6
Brown trout				
200 and up	51		68	
300 and up	31	61	17	25
400 and up	22	43	9	13
500 and up	4	8	0	0

Example:

$$PSD = \frac{\text{Number} \geq \text{quality length (300 mm)}}{\text{Number} \geq \text{stock length (200 mm)}}$$

The PSD values for rainbow trout over 400 mm (trophy length) in Idaho and Washington was 3 and 6, respectively (Table 9). The PSD values for brown trout over 400 mm in Idaho and Washington was 43 and 13 (Table 9).

DISCUSSION

The rainbow trout populations in Washington and Idaho appear to be very similar. The population estimates were virtually the same; 2,012 in Idaho (Corbin Park to the state line) and 1,992 in Washington (state line to Harvard Road). The percentage of rainbow trout in each age group was similar (Table 5). Mean lengths of each age group were also similar (Table 6). Total mortality was similar; 0.66 and 0.58 for Idaho and Washington, respectively. The biggest difference was in the percentage of quality fish; fish over 300 mm. PSD values were 36 and 50 for Idaho and Washington, respectively. The difference between Idaho and Washington was attributed to the higher exploitation rate in Idaho; 17% in Idaho and 6.2% in Washington. The exploitation rates corresponded to the total fishery effort which was over two times greater in Idaho (Post Falls Dam to the state line) than in Washington (state line to Sullivan Road) (Table 4). Angler effort decreased in Washington during the heat of the summer. The lower fishing effort in Washington may be attributed to the unusually hot air temperatures. During interval 6, the weather moderated and fishing pressure increased (Appendix A). The lower exploitation rate in Washington may also be due to noncompliance of tag returns.

Bailey and Saltes (1982) reported total fishing hours in Idaho in 1980 and 1981 as 11,026 hours and 8,816 hours, respectively, and in Washington (Sections 6, 5, and 4) as 8,503 hours and 9,324 hours in 1980 and 1981. These totals were much higher than the 1990 totals for the corresponding sections of 6,193 hours and 2,844 hours in Idaho and Washington, respectively. Again, weather was probably the controlling factor. Even though angler effort was down, catch rates increased from 0.1 fish/hour in 1980 and 1981 for both Idaho and Washington to 0.3 fish/hour in 1990 for both. Our survey did not cover the period after September 7, 1990. It appeared, from our personal observations, that fishing continued at a lower effort in Idaho, but catch rates may be higher, especially as the water cooled down and the fish became more available to the angler.

Mortality

Fishing mortality was relatively low in both Idaho and Washington; 0.28 and 0.09, respectively (Table 10). The difference was attributed to the more restrictive regulations for Washington; 1 fish over 200 mm and the lower fishing effort. These fishing mortality values were similar to those reported by Bennett and Underwood (1988) which ranged from 0.153 to 0.366. Natural morality is the larger component of total mortality and may negate any attempt to improve the fishery through fishing regulations. The combination of post-spawning stress and high water temperature, which can exceed 20°C, may cause most of the natural mortality.

Table 10. Summary of annual and instantaneous mortality rate in the Spokane River from Corbin Park near Post Falls, Idaho down to the Idaho/ Washington state line and from the state line down to Harvard Road near Spokane, Washington, 1990.

State Species	S	A	F	M	Z	E
Idaho						
rainbow	0.34	0.66	0.28	0.82	1.10	0.17
brown	0.42	0.58	0.07	0.80	0.87	0.045
Washington						
rainbow	0.42	0.58	0.09	0.77	0.86	0.06
brown	0.19	0.81	0.20	1.40	1.60	0.10

S = Annual survival
A = Annual mortality
F = Instantaneous fishing mortality
M = Instantaneous natural mortality
Z = Total instantaneous mortality
E = Annual exploitation

Population Estimate

Bennett and Underwood (1988) estimated 19,029 trout in the Spokane River from Post Falls Dam to the Idaho state line. To be directly comparable to the 1990 study, only the middle and lower sections in Bennett and Underwood's study were included in an estimate of 7,858 ± 1,557 trout (from Corbin Park down to the Idaho state line) (Table 11). Bailey and Saltes (1982) reported 889 trout in Idaho in the same section and 167 trout in Washington from the state line to Harvard Road (they suggest this was an underestimate of the true population) (Table 12). Our study reported population estimates of 2,012 and 1,992 in Idaho and Washington, respectively, in October 1990. This represented a 75% decline in Idaho of the estimated population number from the Bennett and Underwood (1988) adjusted population estimate.

Bennett and Underwood (1988) suggested that successful spawning and emergence appeared to be closely related to flows and that a higher recruitment is necessary to provide enough fish to survive to trophy size. Their data indicated minimum flows of over 170 m^3/s (6,000 cfs) from April 1 through June 30 would protect 65% of the available spawning habitat. Flows less than 170 m^3/s would increase intergravel mortality of eggs and fry. During the past ten years, only once in 1984 did flows remain above 170 m^3/s until June 30 (Table 13).

The low population estimate in 1990 can be attributed to four years of flows below 170 m^3/s before June 17, 1986-1989 (Table 13). The high population estimate in 1985 was preceded by four out of five years of flows remaining above 170 m^3/s until the last week of June 1980-1984 (Table 13).

CONCLUSION

Rainbow trout populations in the Spokane River from Corbin Park down to the Idaho/Washington state line and from the state line down to Harvard Road were similar in 1990. Year class strength was still highly variable and appeared to be related to spring spawning and incubation flows. High summer water temperatures may also contribute to high natural mortality, especially in post-spawning adult fish.

Attempts to improve the trout fishing with restrictive regulations may have little effect. Angler exploitation, as determined by returns of tagged fish, was again relatively low in 1990, similar to past studies. Reducing harvest would only allow trout to reach an older age (larger size) if natural mortality factors were also reduced.

Bennett and Underwood (1988) recommended spawning and incubation flows of at least 170 m^3/s to insure more consistent recruitment. Construction of new spawning beds at lower flow levels may also help to insure better recruitment. Maximum recruitment would help to insure a greater number of fish reach an older age.

It is unlikely that high summer water temperatures can be reduced. Warm surface water is drawn from Coeur d'Alene Lake and then heated even more as it passes through the impounded portion of the Spokane River above Post Falls Dam. The frequency and duration of stressful or lethal summer water temperatures has not been determined. Trout in Washington can escape into a thermal refuge provided by significant ground water recharge but there is no thermal refuge in the Idaho portion of the river. We do not know if Idaho fish utilize refuge and if so, do they return to Idaho once temperatures cool? Better knowledge of various conditions that effect trout survival will be necessary to determine how to best enhance this fishery.

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Table 11. Comparisons of population estimates for rainbow trout in the Spokane River in 1981, 1986, and 1990 (Bailey and Saltes 1982; Bennett and Underwood 1988). The 1981, 1986 modified, and 1990 population estimates are for the portion of river from Corbin Park down to the Idaho/Washington state line during fall population estimates. The unadjusted 1986 population estimate is for the Idaho portion of the Spokane River from Post Falls Dam down to the state line.

Year	M	C	R	N	VN	CI	fish/km
1981	61	115	7	899	84,290	567 (63%)	150/118
1986	1,014	1,950	111	17,681	2,344,620	3,001 (16.7%)	1,881/979
1986 (modified)	637	972	78	7,858	631,140	1,557 (20%)	1,288/650
1990	455	374	84	2,012	30,169	340 (17%)	377/154

M = Number of fish marked
C = Number of fish caught during recapture run
R = Number of fish recaptured
N = Population estimate
VN = Variance of the population estimate
CI = Confidence interval

Table 12. Comparisons of population estimates in the Spokane River from the Idaho/Washington state line to Harvard Road near Spokane, Washington, 1982 and 1990.

Year	M	C	R	N	VN	CI	fish/km
1982	43	18	4	167	4,010	124 (74%)	30
1990	447	297	66	1,992	39,046	387 (19%)	376

M = Number of fish marked
C = Number of fish caught during recapture run
R = Number of fish recaptured
N = Population estimate
VN = Variance of the population estimate
CI = Confidence interval

Table 13. Mean monthly flows in the Spokane River below Post Falls Dam, 1980-1989.

Year	Mean monthly flow (cfs) March	April	May	June	July	Date when flows receded to 6,000 cfs
1980	6,194	9,307	12,950	9,308	2,431	6-24
1981	6,740	9,952	12,170	10,048	3,230	6-29
1982	18,780	14,730	19,500	12,760	3,011	6-26
1983	14,890	10,460	12,400	7,483	3,778	6-12
1984	10,550	13,280	14,140	13,570	2,847	6-30
1985	3,380	16,790	18,020	10,360	1,535	6-16
1986	18,230	12,940	9,594	3,806	1,167	6-04
1987	10,160	11,220	8,525	2,113	1,066	5-18
1988	4,824	14,460	7,779	3,621	1,219	6-01
1989	7,569	20,360	16,800	6,674	1,445	6-17

RECOMMENDATIONS

1. Determine the frequency and duration of stressful and lethal summer water temperatures in the Idaho portion of the Spokane River by looking at historical records.

2. Determine movement of rainbow trout between Idaho and Washington.

3. Maintain spring flows of 170 m^3/s from April 1 to June 30 to insure maximum recruitment.

4. Look for opportunities to enhance or create spawning substrate at lower flows.

LITERATURE CITED

Bailey, G.C., and J. Saltes. 1982. Fishery assessment of the upper Spokane River. State of Washington Water Research Center, Washington State University, Pullman.

Bennett, D.M., and T.J. Underwood. 1988. Population dynamics and factors affecting rainbow trout (*Salmo gairdneri*) in the Spokane River, Idaho. Department of Fish and Wildlife Resources, College of Forestry, Wildlife and Range Sciences. Completion Report No. 3. University of Idaho, Moscow.

A P P E N D I C E S

Appendix A

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* IDAHO DEPARTMENT OF FISH AND GAME
* STATEWIDE CREEL CENSUS
* SUMMARY FOR PRESSURE BY INTERVAL AND DAYTYPE
* BODY OF WATER:SPOKANE RIVER EPA NUMBER:1701030500400.00
* 1990
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SECTION NUMBER	INTERVAL	DAYTYPE	BOAT ANGLERS HOURS	BANK ANGLERS HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL ANGLERS HOURS
1	1	Weekday	0	0	0	0	0
1	1	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	2	Weekday	0	0	0	0	0
1	2	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	3	Weekday	0	1225	0	0	1225
1	3	Weekend	0	360	30	0	390
	Interval Totals:		0	1585	30	0	1615
	+/- at 95% C.I.:		0	227	60	0	235
1	4	Weekday	0	225	0	0	225
1	4	Weekend	0	405	54	0	459
	Interval Totals:		0	630	54	0	684
	+/- at 95% C.I.:		0	238	70	0	248
1	5	Weekday	0	472	270	0	742
1	5	Weekend	0	195	41	0	237
	Interval Totals:		0	667	311	0	979
	+/- at 95% C.I.:		0	337	300	0	451
1	6	Weekday	0	621	0	0	621
1	6	Weekend	0	373	27	0	399
	Interval Totals:		0	994	27	0	1020
	+/- at 95% C.I.:		0	439	37	0	441
1	7	Weekday	0	518	0	0	518
1	7	Weekend	0	276	0	0	276
	Interval Totals:		0	794	0	0	794
	+/- at 95% C.I.:		0	334	0	0	334
1	8	Weekday	0	272	0	0	272
1	8	Weekend	0	159	0	0	159
	Interval Totals:		0	431	0	0	431
	+/- at 95% C.I.:		0	196	0	0	196

IDAHO DEPARTMENT OF FISH AND GAME
STATEWIDE CREEL CENSUS
SUMMARY FOR HARVEST BY INTERVAL AND DAYTYPE
BODY OF WATER:SPOKANE RIVER EPA NUMBER:1701030500400.00
1990

SECTION NUMBER	INTERVAL	DAYTYPE	NUMBER KEPT	NUMBER RELEASED	TOTAL CAUGHT	NUMBER RAINBOW	NUMBER CUTTHRT
1	9	Weekday	0	0	0	0	0
1	9	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	10	Weekday	0	0	0	0	0
1	10	Weekend	18	4	22	18	0
	Interval Totals:		18	4	22	18	0
	+/- at 95% C.I.:		18	9	20	18	0
	Section Totals:		601	1332	2009	528	18
	+/- at 95% C.I.:		260	91	306	236	28
2	1	Weekday	2	7	8	2	0
2	1	Weekend	31	92	123	0	0
	Interval Totals:		33	99	131	2	0
	+/- at 95% C.I.:		83	228	265	4	0
2	2	Weekday	0	21	21	0	0
2	2	Weekend	0	122	122	0	0
	Interval Totals:		0	143	143	0	0
	+/- at 95% C.I.:		0	269	269	0	0
2	3	Weekday	0	0	0	0	0
2	3	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	4	Weekday	0	0	0	0	0
2	4	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	5	Weekday	0	0	0	0	0
2	5	Weekend	6	49	55	6	0
	Interval Totals:		6	49	55	6	0
	+/- at 95% C.I.:		9	46	44	9	0

IDAHO DEPARTMENT OF FISH AND GAME
STATEWIDE CREEL CENSUS
SUMMARY FOR HARVEST BY INTERVAL AND DAYTYPE
BODY OF WATER: SPOKANE RIVER EPA NUMBER: 1701030500400.00
1990

SECTION NUMBER	INTERVAL	DAYTYPE	NUMBER KEPT	NUMBER RELEASED	TOTAL CAUGHT	NUMBER RAINBOW	NUMBER CUTTHRT
2	6	Weekday	0	71	71	0	0
2	6	Weekend	41	183	224	30	10
	Interval Totals:		41	254	295	30	10
	+/- at 95% C.I.:		42	299	319	34	22
2	7	Weekday	0	0	0	0	0
2	7	Weekend	12	0	12	12	0
	Interval Totals:		12	0	12	12	0
	+/- at 95% C.I.:		26	0	26	26	0
2	8	Weekday	0	0	0	0	0
2	8	Weekend	0	40	40	0	0
	Interval Totals:		0	40	40	0	0
	+/- at 95% C.I.:		0	80	80	0	0
2	9	Weekday	0	0	0	0	0
2	9	Weekend	0	20	20	0	0
	Interval Totals:		0	20	20	0	0
	+/- at 95% C.I.:		0	40	40	0	0
2	10	Weekday	0	64	64	0	0
2	10	Weekend	0	21	21	0	0
	Interval Totals:		0	85	85	0	0
	+/- at 95% C.I.:		0	104	104	0	0
	Section Totals:		92	690	781	50	10
	+/- at 95% C.I.:		97	485	516	44	22
	SEASON TOTALS:		693	2022	2790	578	28
	+/- at 95% C.I.:		277	493	600	240	36

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*                    IDAHO DEPARTMENT OF FISH AND GAME
*                         STATEWIDE CREEL CENSUS
*               SUMMARY FOR HARVEST BY INTERVAL AND DAYTYPE
* BODY OF WATER:SPOKANE RIVER                    EPA NUMBER:1701030500400.00
*                                  1990
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SECTION NUMBER	INTERVAL	DAYTYPE	NUMBER CHINOOK	NUMBER BROWN	TOTAL BROOK	NUMBER	NUMBEF
1	1	Weekday	0	0	0	0	0
1	1	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	2	Weekday	0	0	0	0	0
1	2	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	3	Weekday	0	0	0	0	0
1	3	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	4	Weekday	0	0	0	0	0
1	4	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	5	Weekday	0	0	0	0	0
1	5	Weekend	0	5	0	0	0
	Interval Totals:		0	5	0	0	0
	+/- at 95% C.I.:		0	9	0	0	0
1	6	Weekday	19	0	0	0	0
1	6	Weekend	0	0	0	0	0
	Interval Totals:		19	0	0	0	0
	+/- at 95% C.I.:		37	0	0	0	0
1	7	Weekday	0	0	0	0	0
1	7	Weekend	35	0	0	0	0
	Interval Totals:		35	0	0	0	0
	+/- at 95% C.I.:		70	0	0	0	0
1	8	Weekday	18	0	0	0	0
1	8	Weekend	0	0	0	0	0
	Interval Totals:		18	0	0	0	0
	+/- at 95% C.I.:		31	0	0	0	0

IDAHO DEPARTMENT OF FISH AND GAME
STATEWIDE CREEL CENSUS
SUMMARY FOR HARVEST BY INTERVAL AND DAYTYPE
BODY OF WATER: SPOKANE RIVER   EPA NUMBER: 1701030500400.00
1990

SECTION NUMBER	INTERVAL	DAYTYPE	NUMBER CHINOOK	NUMBER BROWN	NUMBER BROOK	NUMBER	NUMBER
1	9	Weekday	0	0	0	0	0
1	9	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
1	10	Weekday	0	0	0	0	0
1	10	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
	Section Totals:		72	5	0	0	0
	+/- at 95% C.I.:		86	9	0	0	0
2	1	Weekday	0	0	0	0	0
2	1	Weekend	0	31	0	0	0
	Interval Totals:		0	31	0	0	0
	+/- at 95% C.I.:		0	83	0	0	0
2	2	Weekday	0	0	0	0	0
2	2	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	3	Weekday	0	0	0	0	0
2	3	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	4	Weekday	0	0	0	0	0
2	4	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	5	Weekday	0	0	0	0	0
2	5	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0

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*                      IDAHO DEPARTMENT OF FISH AND GAME
*                          STATEWIDE CREEL CENSUS
*                SUMMARY FOR HARVEST BY INTERVAL AND DAYTYPE
* BODY OF WATER:SPOKANE RIVER                    EPA NUMBER:1701030500400.00
*                                    1990
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SECTION NUMBER	INTERVAL	DAYTYPE	NUMBER CHINOOK	NUMBER BROWN	NUMBER BROOK	NUMBER	NUMBER
2	6	Weekday	0	0	0	0	0
2	6	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	7	Weekday	0	0	0	0	0
2	7	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	8	Weekday	0	0	0	0	0
2	8	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	9	Weekday	0	0	0	0	0
2	9	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
2	10	Weekday	0	0	0	0	0
2	10	Weekend	0	0	0	0	0
	Interval Totals:		0	0	0	0	0
	+/- at 95% C.I.:		0	0	0	0	0
	Section Totals:		0	31	0	0	0
	+/- at 95% C.I.:		0	83	0	0	0
	SEASON TOTALS:		72	36	0	~~578~~	~~28~~
	+/- at 95% C.I.:		86	84	0	~~240~~	~~36~~

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*                    IDAHO DEPARTMENT OF FISH AND GAME
*                         STATEWIDE CREEL CENSUS
*               SUMMARY FOR CATCH RATE BY INTERVAL AND DAYTYPE
* BODY OF WATER:                                   EPA NUMBER:1701030500400.00
*                                  1990
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SECTION NUMBER	INTERVAL	DAYTYPE	CATCHRATE CHINOOK	CATCHRATE BROWN	CATCHRATE BROOK	CATCHRATE	CATCHRAT
1	1	Weekday	0.000	0.000	0.000	0.000	0.000
1	1	Weekend	0.000	0.000	0.000	0.000	0.000
1	2	Weekday	0.000	0.000	0.000	0.000	0.000
1	2	Weekend	0.000	0.000	0.000	0.000	0.000
1	3	Weekday	0.000	0.000	0.000	0.000	0.000
1	3	Weekend	0.000	0.000	0.000	0.000	0.000
1	4	Weekday	0.000	0.000	0.000	0.000	0.000
1	4	Weekend	0.000	0.000	0.000	0.000	0.000
1	5	Weekday	0.000	0.000	0.000	0.000	0.000
1	5	Weekend	0.000	0.019	0.000	0.000	0.000
1	6	Weekday	0.030	0.000	0.000	0.000	0.000
1	6	Weekend	0.000	0.000	0.000	0.000	0.000
1	7	Weekday	0.000	0.000	0.000	0.000	0.000
1	7	Weekend	0.128	0.000	0.000	0.000	0.000
1	8	Weekday	0.067	0.000	0.000	0.000	0.000
1	8	Weekend	0.000	0.000	0.000	0.000	0.000
1	9	Weekday	0.000	0.000	0.000	0.000	0.000
1	9	Weekend	0.000	0.000	0.000	0.000	0.000
1	10	Weekday	0.000	0.000	0.000	0.000	0.000
1	10	Weekend	0.000	0.000	0.000	0.000	0.000
2	1	Weekday	0.000	0.000	0.000	0.000	0.000
2	1	Weekend	0.000	0.133	0.000	0.000	0.000
2	2	Weekday	0.000	0.000	0.000	0.000	0.000
2	2	Weekend	0.000	0.000	0.000	0.000	0.000
2	3	Weekday	0.000	0.000	0.000	0.000	0.000
2	3	Weekend	0.000	0.000	0.000	0.000	0.000
2	4	Weekday	0.000	0.000	0.000	0.000	0.000
2	4	Weekend	0.000	0.000	0.000	0.000	0.000
2	5	Weekday	0.000	0.000	0.000	0.000	0.000
2	5	Weekend	0.000	0.000	0.000	0.000	0.000
2	6	Weekday	0.000	0.000	0.000	0.000	0.000
2	6	Weekend	0.000	0.000	0.000	0.000	0.000
2	7	Weekday	0.000	0.000	0.000	0.000	0.000
2	7	Weekend	0.000	0.000	0.000	0.000	0.000
2	8	Weekday	0.000	0.000	0.000	0.000	0.000
2	8	Weekend	0.000	0.000	0.000	0.000	0.000
2	9	Weekday	0.000	0.000	0.000	0.000	0.000
2	9	Weekend	0.000	0.000	0.000	0.000	0.000
2	10	Weekday	0.000	0.000	0.000	0.000	0.000
2	10	Weekend	0.000	0.000	0.000	0.000	0.000

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* IDAHO DEPARTMENT OF FISH AND GAME
* STATEWIDE CREEL CENSUS
* SUMMARY FOR CATCH RATE BY INTERVAL AND DAYTYPE
* BODY OF WATER:SPOKANE RIVER EPA NUMBER:1701030500400.00
* 1990
****

SECTION NUMBER	INTERVAL	DAYTYPE	CATCHRATE KEPT	CATCHRATE RELEASED	CATCHRATE CAUGHT	CATCHRATE RAINBOW	CATCHRAT CUTTHRT
1	1	Weekday	0.000	0.000	0.000	0.000	0.000
1	1	Weekend	0.000	0.000	0.000	0.000	0.000
1	2	Weekday	0.000	0.000	0.000	0.000	0.000
1	2	Weekend	0.000	0.000	0.000	0.000	0.000
1	3	Weekday	0.000	1.000	1.000	0.000	0.000
1	3	Weekend	0.063	0.000	0.063	0.047	0.016
1	4	Weekday	0.000	0.000	0.000	0.000	0.000
1	4	Weekend	0.108	0.000	0.108	0.081	0.027
1	5	Weekday	0.109	0.000	0.109	0.109	0.000
1	5	Weekend	0.115	0.115	0.231	0.096	0.000
1	6	Weekday	0.209	0.000	0.209	0.179	0.000
1	6	Weekend	0.333	0.104	0.438	0.333	0.000
1	7	Weekday	0.105	0.000	0.140	0.105	0.000
1	7	Weekend	0.170	0.128	0.298	0.128	0.000
1	8	Weekday	0.133	0.000	0.333	0.067	0.000
1	8	Weekend	0.000	0.000	0.000	0.000	0.000
1	9	Weekday	0.000	0.000	0.000	0.000	0.000
1	9	Weekend	0.000	0.000	0.000	0.000	0.000
1	10	Weekday	0.000	0.000	0.000	0.000	0.000
1	10	Weekend	0.076	0.019	0.095	0.076	0.000
2	1	Weekday	0.091	0.364	0.455	0.091	0.000
2	1	Weekend	0.133	0.400	0.533	0.000	0.000
2	2	Weekday	0.000	1.000	1.000	0.000	0.000
2	2	Weekend	0.000	0.600	0.600	0.000	0.000
2	3	Weekday	0.000	0.000	0.000	0.000	0.000
2	3	Weekend	0.000	0.000	0.000	0.000	0.000
2	4	Weekday	0.000	0.000	0.000	0.000	0.000
2	4	Weekend	0.000	0.000	0.000	0.000	0.000
2	5	Weekday	0.000	0.000	0.000	0.000	0.000
2	5	Weekend	0.043	0.340	0.383	0.043	0.000
2	6	Weekday	0.000	0.200	0.200	0.000	0.000
2	6	Weekend	0.131	0.590	0.721	0.098	0.033
2	7	Weekday	0.000	0.000	0.000	0.000	0.000
2	7	Weekend	0.057	0.000	0.057	0.057	0.000
2	8	Weekday	0.000	0.000	0.000	0.000	0.000
2	8	Weekend	0.000	0.600	0.600	0.000	0.000
2	9	Weekday	0.000	0.000	0.000	0.000	0.000
2	9	Weekend	0.000	0.105	0.105	0.000	0.000
2	10	Weekday	0.000	0.421	0.421	0.000	0.000
2	10	Weekend	0.000	0.182	0.182	0.000	0.000

Appendix B. Tags returned from fish caught in the Spokane River, 1990.

Location	Tag number	Date tagged	Date returned
Idaho	2202	3-26-90	9-30-90
	2203	3-26-90	5-26-90
	2206	3-26-90	7-19-90
	0008	3-26-90	5-20-90
	2207	3-27-90	7-03-90
	2209	3-27-90	6-11-90
	2129	3-29-90	10-27-90
	2167	3-29-90	6-25-90
	2170	3-29-90	7-08-90
Washington	2227	3-27-90	6-18-90
	2237	3-27-90	7-25-90
	0040	3-30-90	6-30-90
	42	3-30-90	8-02-90
	47	3-30-90	9-29-90

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management Investigations

Project No.: F-71-R-15

Title: Region 1 Technical Guidance

Job No.: 1-d

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

Region 1 management personnel provided private individuals, organizations, and state and federal agencies with technical guidance, review, and advice on projects associated with, or having impacts on, the fishery resource or aquatic habitat in Region 1.

Author:

Ned Horner
Regional Fisheries Manager

OBJECTIVES

1. To direct land use decisions in Region 1.

2. To furnish technical assistance, advice, and comments to other agencies, organizations, or individuals regarding any items, projects, or activities that are associated with, or may have an impact on, the fishery resource or aquatic habitat of Region 1.

3. To comment on environmental impact statements, provide input regarding timber sales, small scale hydropower projects, highway construction, stream alterations, EPA discharge permits, dock and boat basin development, gas and electrical transmission lines, land use planning, and other environmental impacts on the fishery resource or aquatic habitat of Region 1.

METHODS

Through personal contact, project and document review, and field inspections, we made comments and provided advice on projects or activities associated with or impacting the fishery resource or aquatic habitat of the region.

RESULTS

During 1990, Region 1 fishery management personnel responded to numerous requests for written comments from various agencies. The majority of requests were handled by the Regional Fishery Manager in an attempt to free-up the Regional Fishery Biologists' time for data collection and analysis. A new Regional Program Coordinator position was approved for FY92. Once this person is on line, it will allow a great deal of time now allocated to technical guidance to be shifted back to fish management activities.

Numerous presentations and programs were made to civic and sportsmens' groups throughout the year.

In addition to routine comment and technical guidance, a number of issues required considerably more effort and involvement by regional personnel.

Priest Lake Basin Comprehensive Water Plan

The Department of Water Resources successfully developed a comprehensive water management plan for the Priest Lake/Priest River Basin and it was adopted by the Water Resource Board and implemented July 1, 1990. Fish and Game personnel provided input and guidance relative to the fishery resources of the basin.

The goals and objectives relative to the Priest River Basin support continued utilization of the natural resources for outdoor recreation, and support continued timber harvest using forest practices that protect and preserve the natural resources of the basin. The board encourages and promotes protection and management of critical fish and wildlife habitat, and development and implementation of monitoring and management programs to maintain and enhance the quality and quantity of the basin's water resources. The Board also supports and encourages local land use planning to foster orderly development and to preserve the outstanding natural resources of the basin.

Protected rivers designations were made to protect and preserve the highly valued water resources of the basin. The Upper Priest River from the International Boundary to Upper Priest Lake, Upper Priest Lake, and the Thorofare were designated as state Natural Rivers to preserve their scenic and recreational values and to protect valuable fish and wildlife habitat. All or parts of Hughes Fork, Rock Creek, Lime Creek, Cedar Creek, Trapper Creek, and Granite Creek were designated as state Recreational Rivers to preserve and protect valuable habitat for fish and wildlife. The Priest River from the Priest Lake outlet structure to McAbee Falls was designated as a state Recreational River to preserve and enhance recreational values, and to protect and improve fish and wildlife habitat. Recreational designations were conditions as needed to allow alterations in the streambed for construction and maintenance of bridges and culverts, installation of fisheries enhancement structures and construction and maintenance of water diversion works.

The Department of Water Resources is asked to conduct a study to determine the best management alternatives for the Priest Lake outlet structure relative to all current and potential uses of the lake and the lower river. Fish and Game personnel from the Program Coordination Bureau are conducting an IFIM study to evaluate fish habitat conditions at various flows. Region 1 fish management personnel will be evaluating temperature associations with different flow regimes and assessing return to the creel of stocked catchable rainbow trout. In addition, regional personnel compiled a comprehensive prioritized list of stream segments to be recommended for instream maintenance flows for fish.

Highway Construction Projects

Input associated with the I-90 reconstruction along Coeur d'Alene Lake continued to dominate the majority of highway construction related activities. Private and state lawsuits were filed against the Department of Transportation in an attempt to resolve the questions related to the filling of Coeur d'Alene Lake. Numerous hours were spent responding to lawyers about our knowledge of the events and potential impacts on fish, fish habitat, and resource users. No settlements had been reached as of June 30, 1991.

The mitigation for the lost year class of kokanee was not completed prior to kokanee spawning the fall of 1990 due to delays in completing the spawning beds on the filled portion of the lake. Plans call for creating new kokanee spawning beds along rocky shorelines by dumping gravel from barges. A total of $145,000 has been allocated for this mitigation effort.

The Highway 2 upgrade west of Sandpoint continued to be planned for during 1990. Numerous streams will be crossed and wetlands encroached upon. Efforts were made to identify all areas that impact fish and other aquatic resources, and insure fish passage was maintained and no net loss of wetlands occurs.

Wolf Lodge Creek CRMP

The final design of the stream stabilization project was completed. The project called for over 2,500 cubic yards of structural rock to be used to construct bank barbs, grade control structures, and sediment traps. An estimated 28,000 cubic yards of excess gravel needs to be removed from the channel. Total cost of the project is in excess of $200,000.

The Forest Service committed funding to complete sediment trap and channel excavation on their ownership during 1991 and 1992. This equates to about one-third of the total project.

About 500 cubic yards of structural rock were obtained on the I-90 project, and the Forest Service had a similar amount. As much as 1,500 cubic yards were still needed.

Instream construction permits from the Army Corps of Engineers and State Department of Water Resources were the major issue still unresolved. Riparian landowners must give permission to do work on their property and the permits must include all landowners. We had not found a mechanism that the 60+ landowners agreed on as of June 30, 1991.

Two Adopt-a-Stream programs were approved for the Wolf Lodge Creek drainage that involved stream bank stabilization efforts. Volunteers planted riparian vegetation along unstable banks and will fence riparian areas that are being overgrazed.

Moyie River PGT Pipeline

Department personnel spent considerable time in consultation with PGT/PG&E natural gas pipeline personnel and consultants hired to evaluate the impacts of a natural gas transmission line that will cross north Idaho. The new line will be built parallel to an existing line that crosses the Moyie River eight times. A mitigation package was developed that will use rock grade control structures and bank barbs to stabilize the pipeline crossings and enhance instream cover and rearing habitat for trout. Another major part of the mitigation package was the correction of the passage barrier near the mouth of Meadow Creek. We will continue to follow this project closely to insure the mitigation work is actually accomplished.

Navy Intermediate Scale Measurement System Lake Pend Oreille

The Department of Navy's David Taylor Research Center in Bayview on Lake Pend Oreille has been conducting underwater acoustical research on scale model submarines for many years. A new Intermediate Scale Measurement System (ISMS) was proposed for the lake that would expand underwater acoustical testing. Esonifications exceeding 150 decibels were proposed to be used in the tests. Both IDFG and the users of Lake Pend Oreille disagreed with the Navy's finding of no significant impact. Our concerns centered primarily in two areas: 1) knowledge of actual distribution and abundance of fish in the area proposed to be esonified was not known, and 2) knowledge of the anticipated effect of the proposed esonifications on the various species of fish was not known. The Navy has agreed to do some limited evaluation of our concerns prior to implementing the ISMS. A citizens advisory committee and technical research committee were established. Department personnel will continue to provide guidance on both of these committees.

Schweitzer Creek

The Schweitzer Mountain Resort began a major expansion project in 1990 that involved a total rebuild of the resort, expansion of ski runs and new chair facilities, and reconstructing a portion of the 9-mile access road to the resort.

The resort is located on Schweitzer Mountain about 9 miles northwest of Sandpoint. The area is subject to over 60 inches of precipitation annually and is located on highly erosive glacial ice soils.

Major erosion occurred during the winter of 1990-91 that resulted in tens of thousands of cubic yards of fine and bedload sediment to be deposited in Schweitzer Creek. Another storm on April 5, 1991 resulted in catastrophic failure of the access road and major damage to the Little Sand Creek drainage immediately south of Schweitzer Creek. Damage from both storm events could have been prevented or minimized if proper planning, implementation of plans, and preventative erosion control measures had been taken. The storm events were not unusual or uncommon.

Violations were issued to Schweitzer, Inc. by the Department of Lands for Forest Practices Act violations and by the Division of Environmental Quality for water quality violations. Fish and Game personnel provided input on impacts to the aquatic resource and measures necessary for recovery to be used in consent orders.

RECOMMENDATIONS

Appropriate technical guidance to protect private and public property adjacent to streams, while minimizing damage to aquatic habitat, has been unavailable. Development of a booklet detailing alternatives for stream stabilization should be considered. A cooperative effort between the Department of Water Resources and the Soil Conservation Service may be useful. In the meantime, the Department of Water Resources should be encouraged to take a more active role in technical guidance or referral. Minimum standards for stream alterations should be critically reviewed and modified to be more sensitive to fish habitat and stream channel dynamics rather than site-specific needs of a property owner.

Impacts to Region 1 streams from roading and timber harvest have severely degraded trout and char spawning and rearing habitat. Research to date has focused on the impact of fine sediment on early life stages of salmonids. Many Region 1 streams are further impacted by excessive bedload sediment and loss of large woody debris, resulting in major losses of summer and winter rearing habitat for all salmonid life stages. The need to better quantify the relationships between land use activities, stream channel dynamics, sediment transport, and storage and fish habitat should be a high priority of fishery research.

Shoreline encroachment activities in natural lakes and waterways in Region 1 are increasing dramatically. Activities include construction of bulkheads, breakwaters, boat ramps, entertainment docks, and sandy beaches. Naturally diverse and stable shorelines are being converted into private recreation sites. Fish habitat is being negatively affected by losses of diverse cobble and rock substrate and large woody debris, fine sediment deposition from upland and beach erosion, and excluded from using areas that have been converted to private use. Fish and Game concerns have been reflected in recent permit modification and/or denials, but clear objectives have not been established by the regulatory agencies. The Army Corps of Engineers and State Department of Lands should establish policies that address future public needs and the cumulative impact of private encroachment on aquatic resources.

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